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TRANSACTIONS

OF THE

London Natural History Society

For the Year 1914.

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1915.

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TRANSACTIONS

OF THE

London Natural History Society

K

For the Year 1914.

WITH LIST OF MEMBERS.

LONDON NATURAL HISTORY SOCIETY,
HALL 20, SALISBURY HOUSE, FINSBURY CIRCUS, LONDON, E.C.
L. REEVE & CO., LTD., 6, Henrietta Street, London, W.C.

1915.

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Revised to June 30th, 1915.

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Bacot, A., F.E.S., 26, Westmorland Street, Freetown, Sierra Leone, West Africa.
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Barnes, R. C., Loën, Grange Avenue, Woodford Green.
Bartlett, H. A., 17, Eglington Road, Chingford, N.E.
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Blum, Victor, 23, Valentine's Road, Ilford. (Ent.)
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Bradley, S. W., Forest Dene, Kimberley Road, Chingford, N.E.
Braithwaite, J. O., 18, Warren Road, Chingford, N.E. (Micr., Bot., Ent.)
Braithwaite, Miss D. M., 18, Warren Road, Chingford, N.E. (Bot., Micr.)
Braithwaite, Miss N. A., 18, Warren Road, Chingford, N.E.
Braithwaite, J. V. C., 18, Warren Road, Chingford, N.E.
Bridge, S., 28, Larkham Rise, Clapham. (Micr.)
Briggs, C. A., F.E.S., Rock House, Lynmouth, R.S.O., South Devon.
Brooke, Chas., 160, Wardour Street, W. (Ent.)
Brooke, Miss E. K., 12, Warren Road, Chingford, N.E.
Brooke, Mrs. T. R., 12, Warren Road, Chingford, N.E.
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Brooke, Thos. R., F.R.M.S., 12, Warren Road, Chingford, N.E. (Micr.)
Brooke, Thos. W., 12, Warren Road, Chingford, N.E. (Lep.)
Brown, J. Wontner, 61, Onslow Gardens, Highgate, N.
Burge, Percy F., 154, Lordship Road, Stoke Newington, N.

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Capper, Chas., F.E.S., 6, Leinster Avenue, East Sheen.
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Cockayne, E. A., M.A., D.M., M.R.C.P., F.E.S., 16, Cambridge Square, W.
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Cook, E. Bernard, "The Firs," Woodford Green. (Bot.)
Cooper, B., 103, Bethune Road, Stoke Newington, N. (Lep.)
Cox, Oswald, "Croftdown," Shepherds Hill, Highgate, N.
Crabtree, B. H., F.E.S., Cringle Lodge, Levenshulme, Manchester.
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Cyriax, R. C., 23, Aberdare Gardens, West Hampstead, N.W. (Arch., Aryan question, Indo-European languages.)
Dadd, E. M., F.E.S., Puppelstr., Zehlendorf bei Berlin.
Dell, F. G., "The Hut," Russell Road, Buckhurst Hill, Essex.
Dewshurst, Rev. H., M.A., St. Andrew's Vicarage, Leytonstone, N.E.
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Evans, R. G., The Meadows, Whitchurch Lane, Edgware.
Eynon, Mrs. E. R., 4, Stag Lane, Buckhurst Hill, Essex.
Eynon, Lewis, B.Sc., F.I.C., 4, Stag Lane, Buckhurst Hill, Essex.
Fleming, John, 180, Bishopsgate Street, E.C.
Gardner, J. E., 204, Evering Road, Upper Clapton, N.E. (Lep., Bot.)
Gaze, W. E., 10, The Avenue, Highams Park, Chingford, N.E.
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Greenwood, M., jun., L.R.C.P., M.R.C.S., "Hillcrest," Church Hill, Loughton, Essex. (Arch., Biol.)
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Hodge, A. E., 14, Astonville Street, Southfields. (Lep.)
Holman, Miss Hilda K., "Stanmore," 16, Wilton Road, Muswell Hill, N.
Howard, D. Lloyd, J.P., F.I.C., F.C.S., Little Friday Hill, Chingford.
Hubbard, A. G., B.Sc., 110, Station Road, Chingford. (Orn.)
Jackson, F. W. J., Woodcote End House, Epsom. (Ent.)

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*Kaye, W. J., F.E.S., "Caracas," Ditton Hill, Surbiton, Surrey.
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Le Marechal, W. H., 38, Warren Road, Chingford, N.E.
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Limburg, H. von, "Sunnyside," Montalt Road, Woodford Green.
Loney, Herbert, 354, Goswell Road, E.C. (Ent.)
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Rose, A. J., F.E.S., 1, Harewood Road, South Croydon.
Ross, J., 18, Queens Grove Road, Chingford, N.E.
Routledge, G. B., F.E.S., Tarn Lodge, Headsnook, Carlisle.
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Ryde, W. H., 81, Poppleton Road, Leytonstone, N.E.
Sabine, L. A. E., 83, Lucien Road, Tooting Common, S.W. (Ent.)
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Samuelson, Edward, Fairview, 39, The Ridgeway, Chingford, N.E.
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Satchwell, Miss Kate, Buckhurst Hill College, Buckhurst Hill, Essex.
Sauze, H. A., 35, Collingtree Road, Sydenham, S.E.
Scollick, A. J., F.E.S., "Elmwood," New Malden, Surrey. (Lep.)

Shaw, V. Eric, F.E.S., "Betula," Park View Road, New Eltham, Kent. (Hym. Lep. Micr.)
Sich, Alfred, F.E.S., Coney House, Chiswick, W.
Simes, J. A., F.E.S., "Mon Repos," Monkhams Lane, Woodford Green. (Lep.)
Simpson, W., M.B., B.S., "Polmennor," Snakes Lane, Woodford Green. (Arch. Bot.)
Slater, W., 38, Peterborough Road, Leyton, N.E.
Smith, A. C., "Horton," Mornington Road, Woodford Green. (Ent.)
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Spittle, D. G., 91, Wellington Road, Snaresbrook.
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Stemp, R., Hinton Villa, Heathcote Grove, Chingford, N.E.
Stevenson, H. E., F.C.S., "Entwistle," 43, Empress Avenue, Woodford Green. (Chem.)
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Thomas, G. O., "Wilfrid Lawson Hotel," Woodford Green.
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Tremayne, Mrs. L. J., Whitehall House, 29 and 30, Charing Cross, S.W. (Orn. Arch.)
Van Lessen, R., B.Sc., 69, Downs Road, Clapton, N.E.
Warren, S. Hazzledine, F.G.S., F.Z.S., "Sherwood," Loughton. (Prehist. Anthropology.)
Watt, J. Mc B., Monkhams Farm, Woodford Green. (Farming and Orn.)
Wattson, R. Marshman, 32, St. Andrew's Road, Stoke Newington, N.E.
Weighell, F., 6, Paddenswick Road, Hammersmith, W.
Wilde, Mrs. C. L., Lindfield, Marshall Road, Godalming. (Arch. Bot.)
Williams, B. S., 77, Durham Road, East Finchley, N. (Ent.)
Williams, C. H., 36, Dartmouth Street, Westminster, S.W. (Lep.)
Williams, E., 33, Ashtead Road, Upper Clapton.
Williams, H. B., LL.B., 82, Filey Avenue, Stoke Newington, N.
Willsdon, A. J., 46, Dover Road, South Wanstead, Essex. (Lep.)
Wood, H. Worsley, 31, Agate Road, Hammersmith, W.
Wright, J. A., "Mebbury," Grange Road, Bushey, Herts.
Wrigley, Arthur, 29, Calthorpe Street, Grays Inn Road, E.C. (geol. and prehistoric antiquities.)

* Life Members.

BRANCH ASSOCIATES.

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Barratt, A. K., "Idmiston," Monkhams Avenue, Woodford Green.
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Connoll, Miss E., 5, Connaught Avenue, Chingford, N.E.
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Earl, Miss P., Amberley, Woodside Road, Woodford Green.
Gill, Mrs., "Durlstone," Higham Road, Woodford Green.
Hales, A. G., Glenside, Mornington Road, Woodford Green.
Hornblower, A. B., 32, Forest Drive East, Leytonstone, N.E.
Hubbard, Mrs., 110, Station Road, Chingford, N.E.
Hurdle, W., 2, Redland Villas, Carnarvon Road, South Woodford.
Jones, Miss, 3, Connaught Avenue, Chingford, N.E.
Kilby, G. S., 54, Lombard Street, E.C.
Lees, C. H., D.Sc., F.R.S., "Greenacres," Woodside Road, Woodford Green.
Lewis, T. G., 61, Empress Avenue, Woodford Green.
MacIntosh, Mrs., "Hawthornden," Mornington Road, Woodford Green.

Parsons, Miss L., 36, Forest Drive East, Leytonstone.
Rahm, A. W., "Treknow," Monkhams Lane, Woodford Green.
Rolph, Frank, Harts Stable, Woodford Green. (Micr.)
Roper, F. W., "Stafford Lodge," Chelmsford Road, South Woodford. (Orn.)
Roper, H. W., "Stafford Lodge," Chelmsford Road, South Woodford.
Sheppard, J. H., "Simla Cottage," Snakes Lake, Woodford Green.
Stevenson, Mrs. H. E. "Entwistle," 43, Empress Avenue, Woodford Green.
Stratton, Miss Isabel, 37, Buxton Road, Chingford, N.E.
Thomas, G. W., 86, James Lane, Leyton. (Orn. and Fungi.)
Watson, J. N., "Lauriston," Mayfield Avenue, Woodford Green.
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Wilson, A. J., "Parkdale," Churchfields, South Woodford. (Api.)

COUNTRY ASSOCIATES.

Allen, William, "Southview," Spa Road, Radipole, Weymouth. (Bot.)
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Butler, W. E., F.E.S., Hayling House, Oxford Road, Reading. (Lep.)
Cassall, Dr. R. T., F.E.S., The Surgery, Abertillery.
Cooke, Rev. P. H., M.A., Ickleton, Great Chesterford, Essex. (Bot.)
Culpin, M., M.B., F.R.C.S., (Lieut. R.A.M.C.), Saltersgate, Church Hill, Loughton.
Elford, Rodney R., Glencoe House, 139, Rosary Road, Norwich. (Ent.)
Fison, Eliot Robert, "Sorrento," Brighton Road, Purley.
Grubb, Walter C., Barberton, Traansval.
Hancock, G. D., Mount View, Uffculme, Devon.
Hopkins, Prof. F. G., M.A., M.D., F.R.C.P., F.R.S., 71, Grange Road, Cambridge. (Biochemistry.)
Longley, W., "Avesbrook," Brook Road, South Benfleet, Essex.
Martin, Miss F. E., 3, Linthorpe Road, Stamford Hill, N. (Bot.)
Miller, Miss E., "The Croft," Rainsford Road, Chelmsford. (Lep.)
Moore, J. W., Middleton Dean, Middleton Hall Road, King's Norton, near Birmingham.
Porritt, G. T., Elm Lea, Dalton, Huddersfield. (Lep., Nem., Orth.)
Portway, J. B., jun., 91, The Avenue, West Ealing.
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Ward, J. Davis, "Limehurst," Grange-over-Sands, Lancs.
Whittingham, Rev. W. G., Knighton Vicarage, Leicester. (Bot., Lep.)
Wood, P. Worsley, M.A., Emmanuel College, Cambridge. (Field Botany).

NOTE.—The following abbreviations are used in the above lists :—Api., Apiculture; Arch., Archaeology; Biol., Biology; Bot., Botany; Chem., Chemistry; Col., Coleoptera; Conch., Conchology; Dipt., Diptera; Ent., Entomology; Geol., Geology; Hym., Hymenoptera; Lep., Lepidoptera; Micr., Microscopy; Nem., Nemoptera; Orn., Ornithology; Orth., Orthoptera; Ool., Oology, Zoo., Zoology.

EXTRACTS FROM MINUTES.

January 16th, 1914.—Exhibits.—Mr. L. B. Prout, *Melanthia bicolorata* var. *plumbata* with an extremely dark suffusion near the margin of the forewings, also *Eupithecia subfulvata* and its ab. *cognata* and intermediates, all from Forres and district. Mr. L. W. Newman, series of *Zygaena minos* from Oban, N.B., and also from Co. Clare, Ireland, to show the variation in the species from Ireland and Scotland, the Scotch specimens being darker than the Irish. Dr. E. A. Cockayne, a series of *Boarmia consortaria* bred from a normal ♀ taken at Oxshott in May, 1912, the progeny being 50% melanic and 50% typical. Also three melanic specimens from a Kentish locality. Mr. W. E. King, series of *Tephrosia crepuscularia* and *Lithosia deplana* from Oxshott, and *T. bimaculata* from Epping Forest, including some fine ab. *delamerensis*. Mr. V. Shaw, *Spilosoma mendica* bred from Finchley ova, 1913, including two ♀s having a rusty coloration to all wings.

Mr. C. S. Nicholson, cauliscent form of *Carduus acaulis*, L., and forms of *Carduus arvensis* showing the suppression of the spines on the leaves, vars. *setosus* and *mite*, Koch.

Communications.—Mr. W. E. Glegg reported having seen on December 30th about thirty pochard ♂ and ♀, ♂s in partial eclipse, and two great crested grebe in winter plumage, on Stoke Newington reservoirs.

Miss A. Bush, Miss K. Satchwell, and Mr. A. Wrigley were elected members.

Messrs. A. W. Mera and A. Bacot, the retiring Presidents, gave reminiscences of the old societies, the City of London Entomological and Natural History Societies and the North London Natural History Society. A vote of thanks to Messrs. Mera and Bacot was carried with acclamation.

January 20th, 1914.—Exhibits.—Mr. L. B. Prout, *Cidaria truncata* and *C. immanata* taken at Stonehaven, N.B., 1913. He remarked that in South England *C. truncata* is double brooded, appearing at the end of May and again at the end of August, whereas in Scotland it occurs once only—in July—at the same time as *C. immanata*. Scotch *immanata* are more like *truncata* than English ones, and Scotch *truncata* do not vary very much.

Mr. J. O. Braithwaite the skin of a little grebe, *Podicipes fluviatilis*, obtained at Chingford reservoir.

Mr. A. Bacot read a paper on "Insects and Disease," and illustrated his points with numerous tables, drawings and microphotographs thrown on the screen. Mr. Bacot replied to several questions and stated that he had not found any microbes that would attack blood-sucking parasites. A hearty vote of thanks was accorded Mr. Bacot.

February 3rd, 1914.—The Annual Exhibition.—Exhibits.—Mr. J. Riches, on behalf of Mr. J. P. Mutch, a series of *Abraxas grossulariata* all bred from North London wild larvæ, and including fine pale and dark forms and one ab. *nigrosparsata*. Mr. C. H. Williams, a cabinet drawer of *A. grossulariata*, including several ab. *deleta*, Ckll. (*lacticolor*, Rnr.), ab. *varleyata*, and others. Mr. C. P. Pickett, series of *Angerona prunaria*, the result of sixteen years interbreeding, including ab. *pickettaria*, and a series showing results of breeding under coloured muslins. Also a series of *Agriades coridon*, the result of two years collecting in Hertfordshire, including a long series of ab. *semisyngrapha* and fine underside forms, obsolete and striate; also several ab. *inaequalis* and ab. *roystonensis*. Mr. A. W. Mera, *Agriades coridon* and ab. *semisyngrapha* and other vars.; also *Lycaena argiolus* from larvæ fed on Portugal laurel, producing a larger form than usual. Mr. H. B. Williams, his series of varieties of *Rumicia phlaeas*, including abs. *alba*, *intermedia*, *remota*, *addenda*, *radiata*, *suffusa*, *eleus*, etc., and a series of *Callimorpha dominula* bred from Deal larvæ, and including many fine forms. Also *C. hera* and its yellow variety, and two fine forms of *Nemeophila russula* ♂, one with no black markings on hindwings, and one with dark suffusion over the greater part of hindwings. Dr. E. A. Cockayne, *Cidaria populata*, type, melanic, and intermediate, from East Aberdeenshire, and *C. testata*, pale orange tinted and Norfolk forms, and pale and intermediate males and females, melanic males, and one melanic female. Mr. L. W. Newman, series of *Smerinthus ocellatus* showing considerable variation in colour. *Amorpha populi*, varying from cream to rich pink, and dark vars., *Smerinthus* hyb. *hybridus* (*ocellatus* ♂. *populi* ♀), parts of several broods, showing considerable variation in ground colour and in the spots on hindwings. Two ♀s which occur rarely (about 1%) in this hybrid and a gynandromorph (?), the antennæ intermediate between those of the two sexes. Mr. Bernard Cooper, *Nyssia* hyb. *denhami* and *Lycia* hyb. *harrisoni*. Mr. L. B. Prout, the same two hybrids, and also the reciprocal hybrids of *Tephrosia crepuscularia* and *T. bidentata*, and extreme forms of these two species. The melanic form of *Venusia cambrica*. Mr. R. C. Paton, *Triphaena fimbria*, including some fine dark forms with blackish suffusion on hindwings. Mr. F. W. Jackson, *Agriades coridon*, from Herts, including striate undersides of the ♂, a fine obsolete underside ♀, and a ♂ and ♀ with wings of different sizes. Mr. W. E. King, varieties of *Noctua festiva*, *Apamea didyma*, *Anchocelis pistacina*, and *A. lunosa*, from North London. Mr. V. E. Shaw, a long series of *Aporophila australis*, from Sandown, I. of W., 1913, also a ♂ var. *orientalis*, H.-S., September 13th, 1913, *ibid.* The latter is a very rare form and only three or four specimens have been recorded. Dr. T. A. Chapman, specimens illustrating the convergence of the forms of certain Erebias at high levels:—Of *E. ceto*, *E. melampus*, and *E. pharte*, at Le Lauteret; of *E. pharte* and *E. neanto* at Guarda (Lower Engadine); and of *E. pharte* and *E. eriphyle* in Carinthia.

Whether mimicry or not, the group at each place has a facies that differs from a similar group at other localities, and each species differs from its supposed normal form. *Erebia pharte* is a member of each of

the groups shown. See also *Ent. Rec.*, vol. 26, p. 3, and *Proc. Ent. Soc. Lond.*, December 1913.

Mr. H. Worsley Wood, a long series of the allied species *Xanthia* (*Mellinia*) *ocellaris* and *X.* (*M.*) *gilvago*, showing the distinctions between these two species.

Mr. J. Ross, specimens of *Badhamia panicea*, *Colloderma oculatum*, and *Margarita metallica* (*mycetozoa*) under the microscope. *C. oculatum* was first recorded in Britain in 1911; the specimens shown were from Epping Forest.

Mr. A. G. Hubbard, a set of photographs of tufted duck, whitethroats, and of a curious nesting place of a robin. The photos of the tufted ducks' nest furnish the first record for the North London district.

Commander R. S. Gwatkin-Williams, R.N., was elected a member.

February 17th, 1914.—Exhibits.—Mr. V. E. Shaw, cocoons, pupæ and empty pupa-cases in situ of *Sesia myopaeformis*, also an empty pupa-case of *S. tipuliformis* in situ on a currant twig. Dr. E. A. Cockayne, a fine series of *S. andreniformis* and its parasites *Meniscus pimplator*, *Bracon variator*, *Cabocephalus brericornis*, *Phanerotoma dentata*, and *Thrytocena spinipennis*. Also a box illustrating the pupation of this insect and its parasites. Also a series of *S. scoliiformis* and parasite and larva, pupa case, and cocoons in situ. Pupa cases of *Trochilium apiforme*. *Sesia asiliformis* and its larva and pupa case, and its parasite *Hemetiles obscurus*, from Hyde Park. Mr. L. W. Newman, the life histories of *Sesia culiciformis* and *S. andreniformis*. Living cocoons of *S. andreniformis*. A birch stump from which the larva of *S. culiciformis* had been removed by birds. Also a case containing type specimens of the British Sesiidæ and some photographs. Also, on behalf of Mr. Edelsten, a stick of sallow containing larvæ of *Sesia formiciformis*. Mr. W. E. King, living specimens of *Timandra amataria* and *Boarmia repandata*, bred the same day.

Mr. Stanley Robinson and Mr. R. G. Evans were elected members.

Paper.—Mr. L. W. Newman read a paper "On collecting and breeding the Sesiidæ," which is printed in this volume. Mr. Newman was thanked for his paper.

February 26th, 1914.—To commemorate the fusion of the City of London Entomological and Natural History Society and the North London Natural History Society a reception and supper were held at Palmerston Restaurant, Mr. M. Greenwood, jun., M.R.C.S., L.R.C.P., presiding.

March 3rd, 1914.—Exhibits.—Mr. L. W. Newman, a ♀ specimen of *Gastropacha ilicifolia*, taken in 1913 at Cannock Chase, by Mr. G. B. Oliver. Mr. Newman stated that fertile ova had been obtained, from which he had a number of living pupæ. Mr. A. W. Mera, a series of *Cidaria suffumata*, including two varieties from East Devon, considered by some entomologists to be a distinct species.

Communications.—Mr. W. E. Glegg reported having seen, on

February 10th, a flock of over 200 pochards, ♂ and ♀, nine dabchick, and a grey wagtail, at Stoke Newington reservoirs, and on February 25th, a lesser spotted woodpecker at Highams Park. Mr. E. R. Spragg reported having seen a mistle thrush's nest with four eggs near Hale End, on February 22nd.

Miss Mabel Ashmead and Mr. John Fleming were elected members.

Mr. S. Hazzledine Warren, F.G.S., F.Z.S., gave a most interesting lecture on "The Arctic Beds of the Lea Valley and their Correlation," illustrated by numerous lantern slides. (A paper by Mr. Warren on this subject has been published in the Transactions of the Geological Society.) A hearty vote of thanks was accorded Mr. Warren.

March 17th, 1914.—Exhibits.—Mr. L. W. Newman, fullfed larvæ of *Abraxas grossulariata*, collected at Bexley, March 16th, 1914, on which date larvæ of all sizes were found on the same bushes. Dr. E. A. Cockayne, *Euchloë cardamines* from Ireland, the females having buff hindwings. Mr. A. W. Mera, his series of *E. cardamines*, including a male with yellow tips to forewings. Mr. V. E. Shaw, a series of *E. cardamines*, some with large discal spots, others with very small discal spots; two very small specimens taken at Caterham in 1892; also a fine ♂ with the usual black tips to forewings rayed inwards. Mr. A. Bacot, photographs of the pupæ of *E. cardamines*, showing the variation in colouring in response to environment. Mr. C. H. Williams, a few varieties of *E. cardamines*, including a ♂ with yellow ground colour and a ♀ with two spots on the underside of forewings. Mr. H. B. Williams, a long series of *E. cardamines* and abs. *turritis* and *citronea* and other varieties, including large and small-spotted forms, forms with discal spots to hindwings, a ♀ with two spots on the underside of forewings, a ♀ with a small splash of orange on underside of left forewing, and others; also some living pupæ of the species. Mr. A. J. Willsdon, a piece of cork containing some hundreds of ova of *Nyssia hispidaria*. Mr. J. Riches, a moss found in an old greenhouse, which was identified by Mr. Ross as *Funaria hygrometrica*.

Mr. Donald F. Maitland was elected a member.

Paper.—Mr. H. B. Williams read a paper entitled "The minor variation of *Euchloë cardamines*," illustrated by numerous exhibits.

Mr. A. Bacot proposed and Mr. L. B. Prout seconded a hearty vote of thanks to Mr. Williams for his paper. Dr. E. A. Cockayne and Mr. V. E. Shaw joined in the subsequent discussion.

April 7th, 1914.—Exhibits.—Mr. H. Worsley Wood, a fine series of *Xanthia* (*Mellinia*) *ocellaris*, lent by Herr Rudolf Püngeler, of Aachen. The series included the following—

I. European.—*X.* (*M.*) *ocellaris*, ab *lineago*, Gn., and intermediate forms; a very fine red form from Berlin; a pair of co-types of ab. *intermedia*, Nabich, the ♂ of the usual greyish red, the ♀ yellow. [All these forms, except the Berlin insect, have occurred in England in the Thames Valley locality, but the yellow *intermedia* is of great rarity, and it does not appear from the author's description and figure

(VI. Jahresbericht des Wiener Entomologischen Vereins, 1895) that the varietal name includes both forms].

II. Asiatic.—(*a*) From Uralsk (Russian Turkestan), a short series all paler than typical *ocellaris*, and two ab. *intermedia* with lighter ground colour, and the typical white veins replaced by black; (*b*) from Tien-schan, a very yellow form; (*c*) from Central Asia, very pale yellow forms with all the markings very indistinct; (*d*) from the Alexander Mountain district, three yellow strongly marked forms with black veins.

III.—African. A group of insects—*ocellaris ab. rubra*, *palleago ab. austauti* and *gilvago ab. algirica*, all from Batna, Algiers. The exhibitor stated that he and Herr Püngeler were both of opinion that these were probably forms of a distinct but closely allied species.

Mr. J. Riches, a short series of *Sesia culiciformis* from Bexley.

Mr. L. B. Hall demonstrated the conversion of carbonic acid gas into carbonic acid snow by compression. He said that carbonic acid gas has recently been used by the medical profession in the treatment of skin diseases; it was an extremely important factor in organic life, and an important factor in connection with the erosion of rocks.

Mr. W. E. Watson Baker and Mr. F. Weighell were elected members.

Mr. L. B. Hall read a valuable paper entitled "Wayside Notes," his remarks being illustrated by a series of beautiful lantern slides. The paper dealt with erosion by the waves of the sea, the formation of sand dunes, the reclamation of mud banks, the effect of rivers and streams in breaking up the earth's surface, the action of chemical agencies in erosion, earthquakes, the origin of lakes, and the effect of glaciers on land contours. Mr. Hall was cordially thanked.

April 21st, 1914.—Exhibits.—Mr. Bernard Cooper, a fine asymmetrical specimen of *L. pulveraria*, bred in March from New Forest ova. The band was missing from the right forewing.

Communications. — Mr. W. E. Glegg recorded the following migrants—March 31st, 1914, willow warbler at Highams Park; April 10th, 1914, swallow and sand-martin at Staines Common; April 12th, 1914, tree pipit at Hatch Grove; April 13th, 1914, cuckoo, redstart, and a colony of sand-martins at Broxbournebury. Mr. P. J. Hanson, April 13th, 1914, sedge warbler at Cheshunt. Mr. A. G. Hubbard, April 20th 1914, nightingale at Connaught Water.

Mr. C. Nicholson delivered a lecture on "Wasps and their Ways," illustrated by many beautiful photographs and microphotographs thrown on the screen, and by a very complete series of specimens. He also showed some of the more minute organs under the microscope. Mr. Nicholson was heartily thanked for an interesting and exhaustive lecture.

May 5th, 1914. — Exhibits. — Mr. L. W. Newman, larvæ of *Argynnis paphia* from Killarney. Mr. A. W. Mera, larvæ of *Phorodesma smaragdaria* which had hibernated in captivity. Mr. L. B. Prout, bred

specimens of *Boarmia repandata* from Devon and Scotland, to illustrate the difference between the two races.

Mr. L. J. Tremayne, President of the Research Section, gave an account of that body's activities. He was cordially thanked for his address.

May 19th, 1914.—Exhibits.—Mr. A. W. Mera, on behalf of Mr. B. S. Williams, of Finchley, a melanic specimen of *Biston hirtaria*, bred at Finchley from wild pupæ. This melanic form is of great rarity, only two other specimens being known. Mr. Mera also exhibited ♂s of *Saturnia carpini* from Braemar and from Essex marshes, the Scotch specimens being smaller than those from Essex and distinctly paler, particularly the hindwings. Mr. L. J. Tremayne, living specimens of *Spilisoma mendica* from Farnham, Surrey. Mr. A. J. Willsdon, the reciprocal hybrids of *Biston hirtaria* and *Nyssia zonaria*. Mr. J. Riches, larvæ of *Boarmia gemmaria*, imagines of *Hemerophila abruptaria* from Holloway, *Saturnia carpini* from Kent, *Bombyx rubi* from Eastbourne, *Spilisoma mendica* from Finchley, all bred in 1914. Mr. C. Williams, a series of *Boarmia repandata* from the North of England, Galashiels, New Forest and other districts.

Mr. L. J. Tremayne, *Hesperis matronalis* (dame's violet), *Polygonatum multiflorum* (Solomon's seal), *Allium ursinum* (wild garlic), *Orchis mascula* from near Alton, *Anthriscus vulgaris* and *Polygonum bistorta* from near Farnborough. Replying to Mr. Robbins, Mr. Tremayne said he found that *Anthriscus vulgaris* took the place of *Anthriscus sylrestris* in small areas; in most cases he had found it only in small areas. He had found the species growing together in Bedfordshire.

Communications.—Mr. W. E. Glegg reported that with Mr. Hanson he paid a visit on May 14th to the only well-authenticated breeding-ground of the red-shank in the Society's district; they saw about twelve pairs of the birds apparently nesting, and one nest with four eggs.

Mr. Victor Blum was elected a member.

Mr. E. B. Bishop, Chairman of the Archaeological Research Committee, described that committee's work. Mr. S. Austin spoke of Broxbourne Church, Mr. E. Chapman of Beaulieu Abbey, Mr. L. J. Tremayne of Thaxted Church, Mr. Marshman Wattson of the Church of Harrow-on-the-Hill, and Mr. Bishop of Little Maplestead Church. A vote of thanks was accorded these gentlemen.

May 30th, 1914.—Excursion to Clandon led by Mr. V. E. Shaw, The following species of lepidoptera were observed:—*Pieris brassicae, napi, Lycaena icarus, Coenonympha pamphilus, Nisioniades tages, Nemeobius lucina, Uropteryx sambucaria, Tephrosia punctularia, Asthena candidata, Acidalia remutaria, Eupithecia vulgata, Melanippe montanata, Melanthia fluctuata, Camptogramma bilineata, Fidonia atomaria.* Ova of *N. lucina* were found on leaves of the primrose and cowslip.

June 2nd, 1914.—Exhibits.—Mr. J. Riches, *Colias edusa* ab. *helice*,

bred autumn, 1913, from Eastbourne ova. Mr. A. W. Mera, a foreign hawk-moth taken alive at the West India Docks, and living larvæ of *Psilura monacha*.

Mr. R. W. Robbins reported that several members of the Research Section had spent a week-end in the neighbourhood of Oxted, and there found *Myosotis sylvatica* (wood forget-me-not), on the Downs several orchids, including six or eight plants of *Ophrys muscifera* (fly orchis), and in the beech woods *Neottia nidus-avis* (bird's nest orchis).

Miss Clifton (a member of the Royal Society for the Protection of Birds) gave an interesting address on "The Winged Citizens of London," her remarks being illustrated by lantern slides prepared from Lord Lilford's illustrations.

The Chairman conveyed the thanks of the meeting to Miss Clifton.

June 6th, 1914.—On the ornithological ramble at Hale End the species observed nesting were:—Tree pipit, marsh tit, nuthatch, bullfinch, robin, garden warbler, thrush, cole tit, tree sparrow, starling, hawfinch, swallow, moorhen, wren, chaffinch, willow warbler, blue tit, blackbird, great spotted woodpecker, and hedge sparrow.

June 16th, 1914.—Evening Field Meeting at Chingford.—The following species were observed:—

Lepidoptera.—*Tortrix ribeana*, *T. sorbiana*, *Ptycholema lecheana*, *Elachista argentella*, *Crambus hortuellus*, *Bactra lanceolana*, *Sericoris lacunana*, *Hyponomeuta padellus* (larvæ), *Penthina variegana*, *Acidalia aversata*, *Miana arcuosa*, *Metrocampa margaritaria*, *Cabera pusaria*, *Hepialus lupulinus*, *Acronycta psi*, *Orthosia upsilon* (larvæ on Chingford willows), *Cossus ligniperda* (young larvæ on Chingford willows), *Melanippe sociata*.

Birds.—Chiffchaff, Willow wren.

June 27th, 1914.—Excursion to Leith Hill, led by Mr. V. E. Shaw, F.E.S.—The following species of lepidoptera were observed:—*Epinephele janira*, *Coenonympha pamphilus*, *Bupalus piniaria*, *Bromolocha fontis*, *Melanippe sociata*, *Ematurga atomaria*, *Nemeophila russula*, *Eucosmia undulata*, *Eupisteria obliterata*, *Eupithecia lariciata*, *Thera firmata*, *Hysipetes sordidata*, *Macaria liturata*, *Melanippe montanata*, *Iodes lactearia*, and larvæ of *Hadina pisi* and *Pieris brassicae*.

July 4th, 1914.—Excursion to Colney Heath, led by Mr. C. S. Nicholson.—At Colney Heath is to be seen the interesting flora of the sands and gravels of the sloping banks of the valley through which one of the head waters of the River Colne flows. The flora of the wet banks of the stream clearly shows that the district is one in which the ecological features of plant life can be well examined.

July 25th, 1914.—St. Alban's Cathedral was visited, Mrs. Plomer Young conducting the party over the building; a tour of the exterior was also made.

September 1st, 1914.—Exhibits.—Mr. H. B. Williams, on behalf of Mr. Shaw, ova and larvæ of *Lycaena argiolus*, also a specimen of the white form of the harebell. Mr. W. E. King, specimens of *Zizera minima* taken at Horsley in June, including three fine obsolete forms. Mr. H. B. Williams, a short series of *Euchloë cardamines*, bred in May, 1914, including two specimens (♂ and ♀) with an extra spot on the underside of the forewing immediately below the discoidal; varieties of *Rumicia phlaeas* from Wimbledon, of *Aricia medon* and *Polyommatus icarus* from Boxhill, Banstead &c., and gynandromorphs of *Amorpha populi*, bred August 2nd, 1914, among a few second brood examples.

Paper.—Mr. Williams read a short paper on "The Season's Collecting," for which he was thanked. (Vide *Ent. Rec.*, xxvi., 270.)

September 15th, 1914.—Exhibits.—Mr. C. H. Williams, an interesting and varied series of *Polyommatus icarus*. Mr. W. E. King, series of *Phigalia pilosaria* from Epping Forest, and *Lycia hirtaria* from North London. Mr. H. Goullee, a collection of caddis cases, and specimens of the water scorpion and great water bug.

Mr. W. E. Glegg reported nests of the great spotted woodpecker, bullfinch, and tree sparrow in the Society's sanctuary. In the tree sparrow's nest were nine eggs, an unusual number; he could not say if all the eggs were laid by one bird.

Paper.—Mr. H. Goullee gave an interesting address on "Life Histories of some Aquatic Insects," illustrated by a series of fine lantern slides. A hearty vote of thanks was accorded Mr. Goullee.

October 6th, 1914.—Exhibits.—Mr. G. H. Heath, a fine series of *Boarmia repandata*, including a number of ab. *conversaria*. Mr. C. H. Williams, some specimens of *Polyommatus icarus* from Ireland, also some fine females from England, including ab. *antico-striata* and an obsolete male. Mr. W. E. King, a series of *P. icarus*, mostly taken at Horsley this year, including abs. *striata*, *obsoleta*, *antico-obsoleta*, *sub-obsoleta*, *postico-apicalis*, *costajuncta*, *melanotoxa*, &c.; also, on behalf of Mr. Loney, four fine specimens of *Cerura vinula*. Mr. L. W. Newman, a gynandromorphic *Polyommatus icarus*, right forewing ♀, remainder ♂, except one red lunule on each hindwing; another *P. icarus*, chiefly ♀ but having small ♂ patches, a gynandromorphic *Agriades thetis*, ♀ with a splash of ♂ colour along the costa of the right forewing; a gynandromorphic *Agriades coridon*, ♀ with a small splash of ♂ colour in right forewing; a specimen of *Agriades coridon* ab. *minutissimus*; a series of *Gastropacha ilicifolia*, bred from the ♀ taken at Cannock Chase in 1913 by Mr. G. B. Oliver, and a curious *Zygaena*, small and having four spots only, taken by Mr. Grant of Gravesend on September 3rd, 1912. It was suggested the specimen might be a second brood example of *Z. filipendulae*. Mr. H. B. Williams, a long series of *Agriades coridon* taken in August, 1914, in North Herts, including series of abs. *semisyngrapha*, Tutt, *inaequalis*, Tutt, *parisiensis*, Gerh, a fine series of various obsolete and striate forms, a ♀ of the colour of *Coenonympha pamphilus*, a ♀ with a bluish suffusion on the underside of one hindwing only, numbers of well-marked ♀ upper sides, dark and

light undersides, &c. Also a series of *Polyommatus icarus*, including fine blue ♀ s, interesting ♂ s with pale blotches, and abs. *melanotoxa*, Marrott, *biarcuata*, Tutt, *basijuncta*, Tutt, *costajuncta*, Tutt, forms combining *melanotoxa*, *costajuncta*, *basijuncta*, &c., three ab. *transiens*, Obth., a fine ♀ ab. *antico-striata*, Tutt, four fine ab. *subobsoleta*, Tutt, two of which had the hindwings almost devoid of spots and were taken at the same time, two fine ♂ ab. *obsoleta*, Clark, and other interesting forms.

Mr. V. E. Shaw, pupæ of *Cyaniris argiolus*. Mr. A. J. Willsdon, larvæ, pupæ and imagines of a species of *Micro-lepidoptera* found feeding in a cargo of peanuts captured from the Germans; the species has not been identified.

Mr. C. S. Nicholson, Herbarium specimens representing the aggregate species *Festuca myuros*, L., showing the segregates *F. ambigua*, *F. pseudo-myuros*, and *F. sciuroides*, drawing attention to the chief differences between them. He also exhibited for comparison the allied species *F. uniglumis*.

Mr. J. V. C. Braithwate was elected a member.

Mr. A. G. Hubbard, B.Sc., read a paper on "The Finch Family," illustrating his remarks by a series of lantern slides prepared from his own photographs.

An interesting discussion followed, and Mr. Hubbard was heartily thanked.

October 20th, 1914.—Exhibits.—Mr. L. W. Newman, a series of *Dianthoecia barrettii*, bred from wild larvæ and pupæ from Co. Cork and South Devon, the specimens being very varied and some showing a tendency to melanism; also a very varied series of *Boarmia repandata* including melanic specimens, ab. *conversaria*, and very pale forms, all bred from wild larvæ taken in the Wye Valley.

Mr. A. W. Mera, a series of *Psilura monacha* inbred from Ringwood parents. The series varied from typical to black, the ♂ s showing stronger tendency to melanism than the ♀ s; Dr. E. A. Cockayne, a series of *Agriades coridon* from North Herts, including two very fine ab. *semisyngrapha* and five fine obsolete forms, also abs. *subobsoleta* and *postico apicalis* of *Polyommatus icarus*. Mr. L. A. E. Sabine, a fine variety of *Melitaea artemis* from Co. Sligo; also a specimen of *Polyommatus icarus*, having forewings and body ♂, hindwings ♀. Dr. Cockayne stated that, though only examined under a low microscope power, he thought he could detect androconia on the forewings, showing that the specimen was a gynandromorph.

Mr. J. Riches, a series of *Euchloris smaragdaria* including ab. *obsoleta*, Burrows, bred this year. Mr. H. B. Williams, two pupæ of *Euchloë cardamines*, one ochreous and the other bright green, both of which pupated on the same day in the same box.

Mr. C. S. Nicholson, Herbarium specimen of *Ballota nigra* and *Ballotta nigra* var. *borealis*, the latter being very common in the West of England.

Mr. D. H. Meares read a paper on "British-breeding ducks," which had been prepared by his brother, Mr. C. S. Meares, that gentleman

being on active service with the U.P.S. Corps, Royal Fusiliers. The paper is printed in these Transactions.

In reply to Mr. W. E. Glegg, Mr. Meares said it was a common characteristic of all species of ducks that a large number appeared never to breed. The explanation might be that they were immature birds bred late in the previous year, or that there were not mates for them. The plumage of ducks was a difficult point, for all ducks moulted four times a year.

Messrs. Meares were cordially thanked.

November 3rd, 1914.—Exhibits.—Mr. H. B. Williams, four *Aricia medon* showing obsolescence in the underside spotting; a striate underside of *Agriades thetis*, *Coenonympha pamphilus* ab. *pallida*, Tutt, five specimens from North Herts, *Rumicia phlaeas* ab. *infra-radiata*, Tutt, an ab. *caerulco-punctata*, with pallid blotches on both forewings, and abs. *radiata*, Tutt, and *obsoleta*, Tutt, from Wimbledon, a specimen with left forewing almost entirely white from Herts, and other forms.

Dr. Cockayne, four extreme suffused forms of *Rumicia phlaeas*, from Japan. Mr. L. A. E. Sabine, a storebox of *noctuae* from Co. Sligo, 1914. The series of *Agrotis tritici* were very fine, and a nice form of *Epunda lichenea* was also represented.

Mr. W. E. King, *Aricia medon* from Wendover, including an immense ♀, obsolete undersides and one partially striated; also *Zizera minima* from Horsley, including abs. *obsoleta* and *extrema*.

Mr. A. W. Mera, a series of *Boarmia repandata*, showing the marked darkening which has taken place in the general facies of this species in the London district during the last 20 years.

Mr. E. Chapman gave an instructive address on "The Middle Ages in the Wey Valley," which is printed in these Transactions.

After a discussion in which Messrs. H. B. Williams, Greenwood, Bishop, Tremayne, and Austin took part, a vote of thanks was accorded Mr. Chapman.

November 17th, 1914.—Exhibits.—Mr. W. E. King, a series of *Agriades coridon* from North Herts, including ab. *semisyngrapha*, Tutt, ab. *obsoleta*, ab. *costajuncta*, ab. *basijuncta* and other fine forms; also some light and dark forms of the ♂ from Lewes.

Mr. A. W. Mera, *Cosmotriche potatoria*, two light ♂s, one quite yellow, bred from ova from Wicken Fen; also a ♂ with light blotches from Wansford.

Mr. Ross, *Lunularia cruciata* (hepatic) in fruit, found near Dorking, November 8th; this species very seldom fruits in Britain.

Mr. L. B. Hall, *Tortula cernua* (moss) from Aberford, Yorks, the only known British locality; *Phleum boehmeri*, Shrad., a rare grass from Letchwood, Herts, and *Mentha aquatica*, L., var. *citrata*, Ehrb., from Northaw, Hants.

Mr. J. Riches read an instructive paper on "Chrysanthemums." After tracing the history of the introduction of the plant into Europe, Mr. Riches said that at one time the chrysanthemum grew wild over a

great area of Northern Korea and Northern China, its flowers being yellow, and it being known as "the golden plant." There was reason to believe that the natural yellow chrysanthemum was crossed with an allied member of the family similar to the oxeye daisy of English meadows. From this cross were obtained white as well as yellow flowering plants. In evidence of the early white type to assert itself, Mr. Riches mentioned that there was a tendency to produce early flowering varieties; seedlings of present day varieties often produce a sportive plant, which flowered some months earlier than either of the immediate parents, the flowers of such sports always being white, the colour of the original parent; in colour sports it is just the reverse. The flowers of many varieties seemed to degenerate after a few years, and these had to be discarded. Hundreds of new varieties were sent out by growers each year, but many failed to receive favour because of their weak constitutions or through their flowers not being up to standard. Many varieties were obtained from sports, the stem that produced the sport being propagated.

An interesting discussion followed on several points, and a vote of thanks was cordially passed to Mr. Riches.

December, 1st 1914.—Exhibits.—Mr. H. B. Williams, a regularly halved gynandromorph of *Fidonia piniaria*, left side ♀, right ♂; a ♀ specimen of *Ematurga atomaria* with wing coloration of the ♂; a ♀ *Euchloë cardamines* with a splash of ♂ orange colour on underside of left forewing; a regularly halved gynandromorph of *Amorpha populi*, left side ♀, right ♂; a mixed gynandromorph of the same species, body ♂ left wings and antenna ♀, right antenna and (apparently) wings, intermediate between the two sexes; and eight specimens of *Agriades coridon* ab. *inaequalis*, Tutt. Mr. L. B. Prout, *Cidaria truncata* bred from a Scottish locality and *C. immanata* from the same locality, showing considerable variation. Mr. A. W. Mera, a mixed gynandromorph of *Saturnia carpini*, antennæ intermediate, right side predominantly ♀, but with small patches of ♂ coloration, left side predominantly ♂ but with large ♀ patches, and a gynandromorph of *Boarmia repandata*, left side ♀, right ♂. Mr. V. E. Shaw, a gynandromorph of *Amorpha populi* bred by himself, June 10th, 1909, left side ♂, right side ♀, the antennæ, genitalia and wing markings being equally divided from the centre of the body. Dr. E. A. Cockayne, four gynandromorphous *Amorpha populi*, three being predominantly ♀ in their internal organs, having ovaries but no testes, the fourth predominantly ♂. All showed a mixture of male and female parts in their external genitalia; a *Smerinthus* hyb. *hybridus* (the female of which is always gynandromorphous); two gynandromorphs of *Anthrocera hippocrepidis* (both doubtful); a heterochroic gynandromorph of *Hemerophila abruptaria*, right side ♂, ab. *fuscata*, left side ♀, typical: a heterochroic gynandromorph of *Abraxas sylvata*, right side ♂ ab. *pantarioides*, left side ♀ typical; 37 gynandromorphous *Agriades coridon* from Royston, with one side smaller than the other, and having blue scales and androconia on the small side, one having blue scales and androconia on both sides; two *Agriades coridon* with streaks of

blue colour; a symmetrical gynandromorph of *Polyommatus icarus* having forewings predominantly ♂, hindwings predominantly ♀, and a predominantly ♀ gynandromorph of the same species with streaks of ♂ colour on right forewing and both hindwings, androconia were numerous on the ♂ areas, and the external genitalia purely ♂. Also drawings of dissections of gynandromorphous lepidoptera of various species.

Mr. C. S. Nicholson, herbarium specimens of *Koeleria vallesiaca*, Ascheron, from an outcrop of carboniferous limestone near Weston-super-Mare, and *Koeleria cristate*.

Mr. Glegg reported having seen numerous redwings, whereas they were scarce last year.

Messrs. A. J. Willsdon and C. B. Smith were elected auditors.

Paper.—Dr. Cockayne gave an interesting and instructive address on "Gynandromorphism," a resumé of which is printed in this volume.

On the proposition of Mr. L. B. Prout, seconded by Mr. H. B. Williams, a hearty vote of thanks was tendered to Dr. Cockayne.

December 15th, 1914.—Exhibits.—Dr. E. A. Cockayne, a larva of *Noctua umbrosa*, bred from ovum laid by a ♀ taken in N. Lincs., August, 1914. Also photographs of the following *Agriades coridon*, from Royston.

1. A very asymmetrical underside, the left side larger than the right, and near ab. *parisiensis*, Gerh, the right side typical. The specimen was gynandromorphous, and the exhibitor suggested that the asymmetry was a form of heterochroism.

2. An example not gynandromorphous, which showed possible heterochroism. Very unequal in size on the two sides, both sides as brown as a normal ♀, the orange lunules much larger on the right side. The underside typical on the left wings, near ab. *parisiensis* on the right, the asymmetry being such that no two spots were similar on the two sides.

3. A microphotograph of a portion of wing from a gynandromorphous *Agriades coridon* from Royston, showing three androconia.

Mr. L. B. Prout, a short series of *Melanthia bicolorata*, bred from Forres ova, showing an interesting modification of the *plumbata* form of variation, the forewing being largely infuscated, but with parts—in particular a broad subterminal line—remaining white, while the hindwing showed infuscation in the terminal region only.

The Treasurer's statement, and the reports of the Council, the Oological Curator, the Entomological Curator, and the Librarians were read and adopted.

A set of Rules was submitted and adopted as the Rules of the Society.

The following Officers were unanimously elected:—

President.—Dr. E. A. Cockayne, M.A., M.D., M.R.C.P., F.L.S., F.E.S.

Vice-Presidents.—Mr. A. Bacot, Rev. C. R. N. Burrows, Dr. T. A.

Chapman, Messrs. M. Greenwood, jun., F. J. Hanbury, A. W. Mera, L. B. Prout and R. W. Robbins.

Trustees.—Messrs. A. W. Mera, C. S. Nicholson and L. B. Prout.

Librarians.—Messrs. W. E. Glegg and A. L. Mera.

Curators.—Messrs. S. Austin, C. S. Nicholson and A. J. Willsdon.

President of the Research Section.—Mr. E. B. Bishop.

Treasurer.—Mr. F. G. Dell.

Secretaries.—Messrs. J. Ross and H. B. Williams.

Messrs. F. B. Cross, L. B. Hall, L. W. Newman, H. E. Stevenson and H. Worsley Wood were elected members of the Council.

A vote of thanks was accorded Mr. L. B. Prout for his services as President.

EXTRACTS FROM THE COUNCIL'S REPORT, 1914.

(Adopted at the Annual General Meeting, December 15th, 1914.)

In their first Annual Report, the Council of the London Natura History Society wish to emphasize that the amalgamation of the City of London Entomological and Natural History Society and the North London Natural History Society, has already been completely justified. They desire to assert that it was well that the amalgamation was carried through a year ago, since it has enabled the difficult circumstances created for such Societies by the war now being waged on the Continent, to be met with a strength and resource that could not have been furnished by either of the old Societies singly.

The organisation of the Society for research work has been renewed under the able guidance of Mr. L. J. Tremayne, as President of the Research Section.

In the early part of the year the meetings were well attended and entirely successful. The formation of the new Society was celebrated at a supper, held at the Palmerston Rooms in February, when an enjoyable evening was spent under the genial presidency of Mr. M. Greenwood. Some of our members are on active service, some are doing duty as special constables, and for various organisations, and others have been engaged at business during the evening through the reduction of office staffs by military duties. Consequently the attendance at meetings in the autumn was not so good as it was earlier in the year, but this was unavoidable, and not altogether regrettable, for your Council have learnt, with pleasure, that the Society's members answered promptly to the call for the protection and service of the Homeland in the hour of peril.

Your Council has decided to place on record a list of those members who are on active service; they are:—

Captain R. S. Gwatkin Williams, R.N.
Lieutenant Culpin, R.A.M.C.
Lieutenant J. W. Brown, Army Service Corps.
Second-Lieutenant J. P. Pearce, 2nd Essex Regt.
Col. Sergt. F. W. J. Jackson, Inns of Court Rifles.
Corpl. R. C. Barnes, Royal Fusiliers.
L. Eynon, Sportsman's Battalion, Royal Fusiliers.
T. H. Archer, Queen's Westminster, 16th London.
C. L. Collenette, Penang Maxims.
J. V. C. Braithwaite, R.A.M.C.
T. W. Brooke, Inns of Court O.T.C.
Howard Digby, Royal Engineers.
E. B. Latham, 1st Batt. London Rifle Brigade.
R. Latham, 1st Batt. London Rifle Brigade.
S. G. Lewis, University and Public School Batt. Royal Fusiliers.

F. Reynolds, 2nd Batt. Artists Corps, 28th County of London.
A. K. Barratt, R.A.M.C.
T. E. Legg, R.A.M.C.
A. L. Mera, 10th Batt. Royal Fusiliers.
(Our President, Dr. Cockayne, has recently accepted a temporary post under the Admiralty).

Though the year's work has suffered from the dislocation of business arrangements, and the imperative call of national service, arising from the war, your Council regards the year's work of the Society with no little satisfaction. More has yet to be done before everything runs with perfect smoothness, but this we hope to secure in time; meanwhile, your officers would ask members in case of inadvertence, omission or seeming neglect, for a continuance of that kind forbearance that has hitherto been accorded them.

The branches at Chingford and Woodford continue to do good work. It is with regret that we lose the services of Mr. J. O. Braithwaite as Secretary at Chingford. The branch, at the end of the fifth year of its existence, may be considered to have attained a state of healthy adolescence. Notwithstanding that several former members have left the district during the year, the accession of new members and associates brings the total of names on the rota to 49, a slight increase over that of 1913. During the latter part of the year 1914 the Woodford Branch showed a tendency to fall from the flourishing state that characterised its earlier stages. On the whole, however, the year has been satisfactory. The Chair for 1915 has been kindly accepted by Robt. Armstrong-Jones, Esq., M.D., B.S., F.R.C.P., F.R.C.S., and we must congratulate ourselves that Dr. Jones is able to give us his valued services.

Mr. Dell's statement as Treasurer, submitted to the Council on December 1st, showed a balance of receipts over payments and liabilities of £31 9s. 2½d.; this includes £15 representing life subscriptions. Many subscriptions are outstanding, but owing to the circumstances prevailing members have not been pressed for payment. Members are asked to bear in mind that the past twelve months were a period of light expenditure, owing to no reports and no proceedings being published in the Society's first year. Such outlay will fall upon the revenue of 1915 and succeeding years, and members will recognise the necessity of the Society receiving adequate financial support. The Treasurer's audited account shows that the balance at December 14th was £27 16s. 11d., including £15 life composition fund.

REPORT of the RESEARCH SECTION for 1914.

1. Besides myself the Research Board for 1914 has consisted of Mr. C. S. Nicholson, Mr. H. B. Williams, Mr. R. W. Robbins, Mr. W. E. Glegg, and Mr. E. B. Bishop, every Committee being thus represented. Mr. C. S. Nicholson has acted as Vice-Chairman, and Mr. H. B. Williams as Secretary during the year.

2. The principal matter needing attention has been the automatic enlargement of the local district owing to the amalgamation of the two Societies. The Board considered that the only possible district for the amalgamated Society was the extension of the North London radius, so as to take in the corresponding ground south of the Thames. They accordingly passed a resolution to that effect and transmitted it to the Council. It is understood that the matter has been, or is in the course of being, settled on these lines, and the Board's subsequent deliberations proceeded on the footing of its adoption. A sub-committee was appointed to sub-divide the district, and its report is sent herewith. Each Committee has also been circularised to know whether it is willing to take over the new area, and in cases where replies have not been wholly favourable the Board have endeavoured to make arrangements to meet the difficulty, which it is hoped will thus be overcome without the necessity of forming any actually new committees.

3. Renewed efforts have been made to form Committees for Photography and Mammalia, and some slight success has been achieved with regard to the latter, two competent gentlemen being now waiting in readiness to take part in such a committee when formed, one of whom will be able and willing to act as chairman. But although many personal requests have been made, and the matter has been publicly mentioned both at the central meetings of the Society and at the branches, we have not been able to obtain any other recruits, and in my opinion two or three more at least are necessary to give the Committee a fair chance. Members are earnestly requested to do what they can to secure these as soon as possible, so that the committee can be got under way in 1915. The same remark applies equally strongly to the proposed Photographic Committee, which one would think ought to be easier of attainment, but for which we are sorry to say no one has yet come forward.

4. The Board has endeavoured during the year to get into direct and personal touch with all the Committees and take an active interest in their work. Circulars have been sent out advising various lines to bring them into co-ordination, and in all cases these have been well received. The Board further organised on May 23rd to 25th a week-end outing of the Research Section to the Oxted district. Nine members and one visitor attended, and the outing was much enjoyed and considered a great success. It is hoped that this will become an annual event, as we conceived it to be an excellent idea to keep up the spirit of the members, and give them an opportunity of collaborating in the field. The occasion this year was, of course, utilised to note the

first records of the Southern district, and botanically at least it may be said to have been successful from a scientific standpoint also, as several most interesting species were recorded.

5. The Reports of the five Committees are appended herewith. I have only to add that they are all in excellent condition, and have been working actively and heartily throughout the year.

6. The Board suggest the nomination of Mr. E. B. Bishop as President of the Section for 1915.

(Sgd.) Lawrence J. Tremayne.

REPORT of COMMITTEE on SUBDIVISION of LOCAL DISTRICT SOUTH of the THAMES.

The proposed subdivision is based chiefly on the geology of the various areas, as the nature of the soil has great influence on the character of the country and the prevailing flora, hence also on the fauna. The object aimed at has been to secure a number of areas of workable size that shall each have a characteristic soil and type of country, and it is believed that the comparative study of the records for such areas would have more interest and value than if arbitrary boundaries were chosen. At the same time, with the exception of the county boundary between Kent and Surrey, which has been retained for convenience of comparison with county floras and faunas, the boundaries chosen are such as can be easily followed—roads, streams, and railways, and in one or two places, footpaths.

The subdivisions recommended are as follows :—

	Boundaries.	General Character.
1. Weybridge ..	N. the Thames ; W. and S. District boundary ; E. from Hampton Court Station, the railway to Surbiton Junction thence through Claygate and Oxshott to District boundary.	Practically all Bagshot Sands with heaths, &c., and round Chertsey the lower river gravels.
2. Wimbledon ..	N. and W. the Thames ; E. River Wandle ; S. Railway from Kingston through Raynes Park to Wimbledon Junction, thence through Morden to the Wandle.	Chiefly higher river gravels of Putney and Wimbledon Commons and Richmond Park.
3. Chessington ..	N. Boundary of 2 ; W. the Thames and boundary of 1 ; S. and E. District boundary, road from Bookham Church to Fetcham and Leather-	Almost all lowlying country of London Clay, with Commons of London Clay and gravel at Epsom, Ashtead and Bookham. Chessington village is cen-

	Boundaries.	General Character.
	head Station, footpath and road to Ashtead, Epsom and Ewell, thence S. of Nonsuch Park to Cheam, Sutton, Carshalton and to the Wandle at Beddington and thence northwards.	tral in the division in the midst of typical country.
4. Norwood	W. and S. River Wandle to Waddon, thence main road through Croydon to Coombe Lane, Addington and County boundary; N. Thames; E. County boundary.	Chiefly lower river gravels of Streatham, Tooting and Mitcham, hills of London Clay round Norwood, and Blackheath and Thanet Sands round Shirley.
5. Banstead.. ..	W. and N. Boundaries of 3 and 4; E. main road from Croydon to Merstham; S. Boundary of 7 to Merstham Church.	Chalk with cappings of Woolwich beds and Thanet Sands at Headley and Watton, &c., and along the northern edge.
6. Caterham ..	N. Coombe Lane and Addington Road; W. Brighton main road; S. Boundary of 7; E. County boundary.	Chalk with capping of sand at Worms Heath and on the northern edge; contains the highest chalk ridges.
7. Holmesdale ..	N. Railway from Betchworth to Reigate, main road to Merstham, just S. of Church, thence road and footpath (the "Pilgrims' Way") at foot of downs to County boundary; E. County boundary; S. District boundary.	The valley of Gault clay and the Greensand ridges below the chalk. A few small spurs of chalk unavoidably project into the northern edge.
8. Blackheath ..	N. River Thames to Greenwich, thence railway from Greenwich Station through Woolwich to R. Cray at Crayford (boundary of 9); W. County boundary; E. the Cray to Orpington; S. road from Addington to Hayes turning right past Coney Hall to Keston Church, thence road and footpath direct to Farnborough, and road direct to Orpington and R. Cray.	A large district but homogeneous and difficult to divide. Chiefly Blackheath Sands (hence name) and Woolwich Beds, with some London Clay in valleys. Much sandy common land — Blackheath, Hayes, Chislehurst, Bexley, Abbey Wood, &c.
9. Kent Marshes ..	N. River Thames; S. Railway from Greenwich	All alluvial marsh land except small patch of chalk

	Boundaries.	General Character.
	through Woolwich and Dartford to boundary at Northfleet.	at Dartford.
10. Darenth	N. Boundary of 9; E. District Boundary; W. River Cray to Orpington, thence road to Farnborough; S. main road from Farnborough to Sevenoaks, to the top of the Halstead Tunnel, thence bye road to Shoreham Castle on Darent, River Darent to Chatham main line, and railway thence to boundary.	Chalk subsoil throughout, but capped with large areas of Thanet Sand, on which are extensive woods —Darenth Wood, Joydens Wood, Hallards Wood near Chelsfield, &c.
11. North Downs ..	N. Boundary of 8 and 10; W. County boundary; E. District boundary; S. "Pilgrims' Road" from Titsey to Chevening Park continuing direct across the Park and by footpath and road to Otford Station, thence footpath and road direct to Kemsing.	All high chalk land with a good deal of "clay with flints," *i.e.*, weathered chalk, on the highest parts. Few villages and many small woods.
12. Westerham ..	N. Boundary of 11; W. County boundary; S. District boundary.	Gault in valley below the chalk ridge. Greensand ridges beyond. Similar to 7.

(Sigd.) R. W. Robbins.
E. B. Bishop.

ARCHAEOLOGICAL COMMITTEE. REPORT for 1914.

1. During the year the Committee has made the following inspections:—

(a) January 31st, East Ham Parish Church, Essex.
(b) April 25th, Darenth Church, Kent.
(c) July 11th, Boxgrove Priory Church, Sussex (annual week-end outing).

The records of above inspections are being prepared and will be deposited in the Society's library.

2. The following papers have been provided at the instance of the Committee for the Society's syllabus:—

Read at Chingford Branch—

(a) February 27th. "A plea for the preservation of our Ancient Buildings," by E. B. Bishop.

Read at Salisbury House—

(b) May 19th. "The Records of the Archaeological Committee," by Members of the Committee.

(c) November 3rd. "The Middle Ages in the Wey Valley," by E. Chapman.

Mr. Bishop has presented his paper to the Library.

3. The Committee organised a visit of the Society to St. Alban's Cathedral on July 25th.

4. In view of the extension of the Society's local district to include a 20 mile radius south of the Thames the work of the Committee will in future embrace the increased area.

5. Mr. A. Bacot having proceeded to Africa to take up professional duties has resigned membership of the Committee. The number of members now stands at nine.

(Sgd.) E. B. Bishop, *Chairman.*

(Sgd.) S. Austin, *Hon. Sec.*

November 3rd, 1914.

ORNITHOLOGICAL RESEARCH COMMITTEE. ANNUAL REPORT for 1914.

The number of birds recorded in the district now stands at 137, as against 136 last year. The nesting species number 87, the same as that of last year. The new occurrence is that of the

Mealy Redpole (*Linota linaria*). More than a dozen of this species were caught in a garden in Chingford, in November, 1913. Mr. A. G. Hubbard, who vouches for the record, saw seven of the birds and placed two in his aviary.

Other interesting records are as follows: —

Long-Eared Owl (*Asio otus*). One shot at Chingford, October 11th, 1913, by Mr. W. W. Hartwell. Reported per W. E. G.

Little Owl (*Athene noctua*). Four young were hatched in an apple tree, afterwards living in a rabbit hole, at Enfield, in 1913. Reported by Mr. R. B. Lodge per W. E. G. This species was observed also at Chingford, on August 16th, 1913, and March 13th, 1914, and two young birds on August 1st, 1914. Reported by Mr. W. W. Hartwell per W. E. G.

Spotted Crake (*Porzana maruetta*). One shot at Chingford, September 26th, 1914. Reported by Mr. W. W. Hartwell per W. E. G.

Lesser Redpoll (*Linota rufescens*). Nest with eggs on east side of Epping High Road, June 25th, 1914. Reported by Mr. A. G. Hubbard.

Pochard (*Fuligula ferina*). A flock of over 200 male and female was observed on Stoke Newington Reservoirs, on February 10th, 1914. Reported by Mr. W. E. Glegg. This is the largest flock recorded in the district.

Teal (*Nettion crecca*). A small flock was seen on Walthamstow Reservoirs, on January 27th, 1914. Reported by Mr. W. E. Glegg.

Tufted Duck (*Fuligula cristata*). Nested in new Public Park, Winchmore Hill, 1913. Reported by Mr. R. B. Lodge per W. E. G.

The Committee has held during the year nine meetings, including five informal meetings, and seven excursions. Of the latter mention may be made of the visit to the Heronry at Wanstead Park. It is gratifying to note that the authorities are affording the birds all possible protection. The rooks, which are a menace, are not permitted to nest on Heronry Island, any nests built being destroyed. The colony is evidently in a thriving condition, as the keeper stated that there were 56 nests in 1914, being three more than in 1913.

One hundred and thirty-one birds have been ringed during the year under the "British Birds" marking scheme. Although this is less than the previous year it cannot be considered as unsatisfactory, as the ringing of all the Tits has been discontinued, and it must be borne in mind that this particular group formed a large part of the birds ringed by the Committee.

Some interesting recoveries are to be recorded :—

Great Tit, ringed at Hale End, January 12th, 1911, recovered same place, August 14th, 1914.

Great Tit, ringed at Woodford, December 29th, 1912, recaught same place, December 31st, 1913.

Great Tit, ringed at Woodford, June 1st, 1913, recovered same place, March 11th, 1914.

Blue Tit, ringed at Hale End, June 4th, 1913, recovered at Walthamstow, December 24th, 1913.

Nuthatch, ringed at Woodford, January 10th, 1913, recaught same place, January 12th, 1914.

Common Tern, ringed at Blakeney Point, June 23rd, 1914, recovered at Felixstowe, July 28th, 1914.

Common Tern, ringed at Blakeney Point, June 23rd, 1914, recovered at Lowestoft, July 29th, 1914.

The photographic collection has made some progress, but still further support is invited.

The Committee provided three items for the syllabus :—On June 2nd, a Paper, "Winged Citizens of London," by Miss Clifton (R.S.P.B.); on June 6th, a ramble, including a visit to the Bird Sanctuary; and on October 20th, a Paper, "British-Breeding Ducks," by C. S. Meares.

Mr. P. J. Hanson has been elected a member of the Committee, the membership of which now stands at five.

The report of the Bird Sanctuary Committee has been received and is subjoined.

Report of the Bird Sanctuary Committee.

Mr. A. G. HUBBARD, *Secretary*.

Last year being the first year of the Society's bird sanctuary, the Committee reported at some considerable length, giving an account of the work done in strengthening the fences, fixing nesting boxes, and also enumerating the chief bird observations. In 1914 the work has

been conducted in a similar manner. The nests recorded were somewhat more numerous, the Bullfinch, Wren, Great Spotted Woodpecker and Mistle Thrush being new records. The work of ringing the nestlings has been continued. The interference with nesting boxes by unauthorized persons has been greater.

Probably the most interesting Ornithological records have been :—

1. A Great Spotted Woodpecker enlarging the hole of a nesting box and afterwards nesting in the box.
2. A Tree Sparrow's nest with nine eggs in nesting box.

The Committee regret to report that in November the new owner of Hatch Grove, according to agreement, called upon the Committee to take down the Society's notice boards, remove the gate and re-instate the fence, this has been done, but it is hoped that some new arrangement may be made with the owner for the future.

For the Ornithological Committee,

William E. Glegg, *Secretary.*

November 20th, 1914.

REPORT of BOTANICAL COMMITTEE.

42, Avenue Road, Highgate,

November 13th, 1914.

The Chairman of the Research Section,

London Natural History Society.

Dear Sir,—The work of the past year calls for little comment, seeing that it consists largely of filling up the gaps which exist in the records of the distribution of the plants within the various divisions of our district. None of these call for any special comment. During the year it has been decided to extend the operations of the Society to the south of the Thames, and a Sub-Committee is now considering the question of the definition of the boundaries to be assigned to the divisions of this new area, consistent with the geological features of the district.

The interest in the Herbarium has been maintained, although the additions thereto have materially fallen below the average additions of the past few years.

It is to be hoped that the members of the Society will remember that this department of our work offers ample scope for their activity.

Yours faithfully,

C. S. Nicholson.

LEPIDOPTERA RESEARCH COMMITTEE. FIFTEENTH ANNUAL REPORT, 1914.

1. The Committee this year has been re-organised. Its members now consist of Mr. J. E. Gardner, Mr. H. G. Payne, Mr. Louis B. Prout, F.E.S., Mr. R. W. Robbins, Mr. V. Eric Shaw, Mr. Lawrence J. Tremayne, Mr. Harold B. Williams, and Mr. H. Worsley Wood. Mr.

Williams has been appointed Chairman, and Mr. Tremayne has undertaken the duties of Secretary during the present year, but now retires in favour of Mr. Williams.

Following the precedent set by some of the other Committees, the Committee early in the year drew up and adopted the following statement of Aims with regard to its work, which was duly sent in to the President of the Research Section :—

(a) To study Lepidoptera individually and collectively.

(b) To promote the study of and interest in Lepidoptera in the Society.

(c) To do all in our power to protect Lepidoptera in the Society's district, and especially to discourage indiscriminate collecting.

(d) To make a complete list, with full notes and records, of the species of Lepidoptera found in the Society's district, and to make a special study of the Lepidoptera of such district.

3. Four meetings have been held during the year, and one week-end excursion was taken to Polegate, and was much enjoyed by those members attending, although collecting was only fair.

4. Attention has been given to the necessity for keeping the Lepidoptera interest at the Society's general meetings well to the fore. The Committee have made it their business to provide at least one fixture especially devoted to Lepidoptera on each syllabus, and have also offered to do the same for the local branches. Moreover, all the Lepidopterists on the Society's books have been circularised by the Committee, with a view to keeping up the exhibits at general meetings.

5. A number of other matters have been settled by the Committee which do not find a place in this report. Owing to the work of reorganisation in the first instance, and subsequently to the difficulties occasioned by the war to some of our members, it has not been possible to do a great deal in 1914, but various other projects are in contemplation which it is hoped will mature in 1915.

HAROLD B. WILLIAMS, *Chairman.*
LAWRENCE J. TREMAYNE, *Secretary.*
November 3rd, 1914.

PRESIDENTIAL ADDRESS.

(Read January 5th, 1915, by LOUIS B. PROUT, F.E.S.)

The year which has just closed has been an impossible one to review adequately from the naturalist's point of view. For the past five months we have been cut off from communication with some of the chief centres of activity and the usual sources of our information; and although it may reasonably be assumed that on the Continent even more than at home, that activity has been considerably curtailed, one cannot venture to say that there may not have been important memoirs published or other important happenings. The year's obituary certainly included the name of one very eminent German biologist, Dr. August Weismann; and although we cannot but deplore the fact that the latest we in this country heard of him was as one of the signatories to the very un-scientific manifesto of the German scientists, yet any asperity of feeling should be softened down by the knowledge obtained through his daughter that he was at the time very broken in health and not physically in a condition to take an unbiassed view of a situation in which national antipathies are so deeply involved, and misstatements so widely current. Certain it is that his masterly contributions to our knowledge of histolysis and histogenesis, and his luminous theory of germ-plasm and germinal selection, belong to the world's heritage, and will be studied long after the unfortunate manifesto is buried in oblivion.

Our own country has recently lost two almost life-long workers in the special branch of natural history which most particularly appeals to me—Lepidopterology. With Dr. J. H. Wood, the great authority on Herefordshire Lepidoptera, and an excellent worker at the smaller Microlepidoptera, in which—for example, in *Coleophora* and *Nepticula*—he made some important discoveries, I was not in personal contact, although his name was already a "household word" at the date of my first entry into the entomological community. With Mr. W. Warren, on the other hand—who also commenced writing nearly 40 years ago as an earnest student of the Microlepidoptera, especially of their life-histories—I have for several years been in the closest communication; since 1893 he had been specializing in the *Geometridae*, and in my own earlier studies in this family he was my constant guide, counsellor and friend; to his unfailing courtesy and wide range of knowledge of the subject, I owe more than I can calculate.

To me as a Geometridist—if I may be allowed to coin one of those terms indicative of restricted specialization, which Mr. Godman more than 20 years ago predicted must soon come into use—the year 1914 was further memorable for the appearance of F. N. Pierce's laborious and long-awaited monograph on "The Genitalia of the Geometridæ." The present would not be an appropriate occasion for discussing the many questions of taxonomy, nomenclature, or other matters of purely specialistic interest which are suggested by this work, but I shall in

part employ it as a text on which to hang a general discourse upon some of those considerations which arise in my mind when I contemplate such an undertaking as a "presidential address." My chief fear is not that I shall be too specialistic for my audience, but that I shall be too reminiscent of matter to which I have already repeatedly given public utterance; for I cannot forget that I have had the honour to give several such addresses to each of the Societies of which the present one is composed, and that my range of interests of this kind is lamentably restricted.

To say of any memoir—or any branch of research—that the fact of its dealing exclusively with a particular structure in a particular group of organisms, is at once its strength and its weakness, may sound somewhat paradoxical; yet I feel that it is substantially true. It is a mere commonplace nowadays that Nature is *one*, and that there is inevitable loss—an inevitable source of error—in erecting any such artificial barrier as is involved in studying only in one family an organ which has its homologies in many other families, more often than not, perhaps, throughout the animal kingdom, or even throughout organic nature. On the other hand, concentration is an essential condition of successful investigation, and concentration is out of the question unless one consents to occupy a relatively narrow field. I have often thought —and I feel it very strongly in dealing with such a subject as that which is now before us—how very much simpler it would be if Nature had accommodatingly placed every "family" in a sort of watertight compartment, free of any troublesome leakages from other families. "Much simpler," indeed, but in all probability immeasurably less fascinating; for after all, it is the apparently limitless interrelations and interlacings, the correlations and the complex affinities that give zest to our studies, especially when we betake ourselves to the paths of actual research.

On the old orthodox theory of "Special Creation" such watertight compartments might doubtless have been expected; indeed I, for one, can never quite grasp what authors like Linné—or, to cite a far more modern example, that eminent entomologist John Obadiah Westwood —understood by "relationship" between species or between genera or families, etc. One can only conclude that it was a figure of speech, intended to convey nothing further than the impression of a superficial similarity *analogous* to that observable between blood relations within a single species.

On any or all of the "evolution" theories, on the other hand—unless one can push "Mutation" to an extravagant limit, at which it would almost cease to be an *Evolution* theory—it cannot reasonably be expected that the zoological or botanical entities—whether species, genera, families, or any other grade in classification, shall be either independent or show any uniformity in the degree of their divergences *inter se*. I need scarcely labour this point, which must be sufficiently obvious to those who have given thought to the subject, to say nothing of those who are intimate not only with what should be *ex hypothesi* but with what actually *is* in the organic world. I should hardly have mentioned it at all but that one does occasionally come across good

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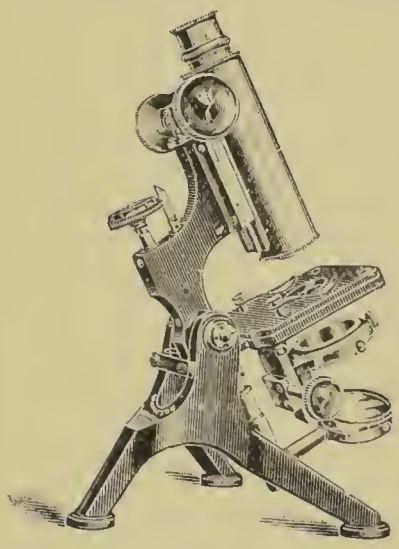

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naturalists who have some pet weakness that they cannot give up. Thus even that leader of lepidopterists, the late J. W. Tutt, who wrote much that was very shrewd and very convincing on the occasional artificiality of our conception "species," yet strangely clung to the view that in some mysterious way a "genus" was a natural grouping, requiring only a sufficiently acute and accurate naturalist to discover it. I have on former occasions confessed to my own bias in the opposite direction—that a "species" is, of the two, more "natural" than a "genus;" but I am willing to confess further, that neither is strictly definable for all cases. I trust I have not worded my thought so badly as to give the impression that we have *never* a right to regard a species or a genus as perfectly sharply differentiated, and, therefore, in a sense "natural." Very far from it; I only mean to affirm that if "species" and "genus" were products of nature they would be found applicable throughout nature's *entire* realm, and that this is not the case. In a nutshell, it is simply a question of the *degree of separation through the extinction of intergrades*. The "missing link," which has been the subject of so much, and often so acrimonious controversy in one position of the zoological series, is certainly discoverable in many positions, and sometimes complicates the question of the validity of species. In other cases it is only reasonable to suppose that intergrades have absolutely died out, sometimes without leaving even fossilized remains to help us complete our chain. We are then justified in speaking of a "very distinct" or "very natural" species. Yet it may still show structural characters enough in common with its nearest ally to fall within the pale of the same "genus" on a taxonomic scheme. But if still more intergrades have died out, leaving the survivors more obviously isolated in structure, the systematist will claim that the differences are "subgeneric" or "generic." Now how any thoughtful person can fail to realize that the degree of divergence that should justify the choice of one of these terms rather than another must remain a question of personal opinion, I am at a loss to comprehend. *If* we knew every species in the world, living or extinct, and *if* we had made an exhaustive study of every anatomical and physiological character of every species (sufficiently wild hypotheses, in all conscience!), we might be able to arrive at a consensus of opinion regarding the use that should be made of these characters taxonomically; but even this is by no means certain, and we might well have to fall back upon some arbitrary scheme such as to give a common generic name to each group of a dozen which had the most characters in common.

In spite of this proved artificiality of the "genus," it is, I fear, exceedingly unlikely that we shall be able to escape from its thraldom, and so those of us who essay any systematic work are confronted with the question—On what general principles should it be grounded? After what I have said, you will not expect me to be able to suggest any cut-and-dried scheme, or to assert that absolute consistency is possible, still less to claim such for myself and my own work. As a generalization, I pointed out some years ago (*Trans. City Lond. Ent. Soc.*, xix, 17-20) that genera founded on very small differences were neither historically defensible nor practically convenient, and that our increasing

knowledge of the more detailed relationships within a genus was better met by the erection of sub-genera, or other sectional divisions within a genus, than by creating new and smaller genera. I will not repeat my arguments with the exception of the one which has the most direct bearing on the lines of thought which I am pursuing this evening. Granting that a "genus" is, more or less, a mere *convention*, and that we are therefore unfettered in its precise application ; and bearing in mind that the chief feature of the genus is its *name*—for, say what we will, the systematist does, and must, recognise a very large number of grades in relationship, all of which will be equally recognised in good monographic work, but only one of which, other than that of the species, will take part in the "binomial" ; with these considerations in view, can we not agree that the application of such names to the smallest groups of allied species is a two-fold evil? In the first place it obviously increases very materially the burden on the memory ; the field worker, for instance, is very justly reproved if he talks about having collected "*rubi*," for there are, even in Britain, three Lepidoptera bearing that specific name, to say nothing of other orders of insects, or other classes of animals; it is rightly demanded of him that he shall use the binomial. But if most of our genera are to consist of two species, or one only, as the position taken by some extremists would logically demand, the worker at British Lepidoptera will have to use something from 1,000 to 1,500 generic names, and the worker at the Palæarctic Lepidopterous fauna perhaps some 7,000. In the second place a generic name is robbed of a great part of its utility when it is very restricted in application : probably the chief uses that are made of it, other than as a mere additional clue to the species-name with which it is combined, are in general discussions of geographical distribution or of morphology, etc., and it is more than doubtful whether the generic names of such restricted application could convey much information on these subjects. If, for instance, the generic name *Papilio* be allowed the comparatively wide application which is given it in Rothschild and Jordan's revision, we have something which we can utilize in discussions of zoogeography or morphology ; but if we have a separate generic name for every pair of species, we can convey far less generalizations through it. Of course the genus-splitters are ready with their reply ; they *have* a term for the genus *Papilio* of Rothschild and Jordan—perhaps a tribal or sub-tribal designation, *Papilionidi* or *Papilionici*. This is not to be denied. As I have already indicated, we need many more terms than we possess if we are to show all the recognizable grades of relationship. But my main argument remains untouched ; namely, that the convenient course is to use the most concise term for the grouping on which we have to base the most generalizations.

Ideally then, were my knowledge and judgment equal to the task, I would wish to content myself with such a limited number of genera as should not prove an insufferable burden on the memory of the practical worker, and as should at the same time indicate some well-recognized structural deviations and lend themselves to some logical conceptions of geographical distribution. I would not, except after

the most exhaustive study which I could bestow upon it, constitute a single genus of species from the Sandwich Islands and Greenland, however many characters they possessed in common; the *a priori* evidence against a near phylogenetic relationship in such a case being so overwhelmingly strong. Neither, on the other hand, would I willingly retain in a single genus species which showed marked morphological divergence, even though there might be a possibility that such divergence was of comparatively quite recent date; for this course would vitiate or stultify taxonomic work.

Thus I will not admit that a hard-and-fast system of generic grouping—a dogmatic ruling that this or that structural character is, or is not, of generic value—could be otherwise than a hindrance to the very purposes which are supposed to be served by generic classification. Nor will I admit—and this brings me back more closely to my "text"—that a hard-and-fast system of generic grouping founded on a single character can be acceptable. A generic name, in order to serve its full purpose, should be a sort of shorthand sign for the fullest possible diagnosis, it ought to convey implicitly a yes or no to every question of morphological variability which has yet been studied in the group to which it belongs. Here is the crux of the monographer of a special organ like Mr. Pierce. It is scarcely putting the case too strongly to say that he is betwixt the devil and the deep sea. The rôle of "devil" in the present instance was played by my late friend Mr. Tutt, who, by a criticism on the author's previous volume on the *Noctuidae*, tried, and not without some success, to beguile him into the slippery paths of reclassification; the gist of Mr. Tutt's criticism being that Mr. Pierce had discovered numerous hitherto unnoticed indications of affinity and had failed in his duty in that he had not made them clear by any re-grouping of the species. The "deep sea" is personified by the present speaker, who threatens to swallow up Mr. Pierce's new system in a wider expanse—though far less intensive—of studies in Geometrid structure.

What ought Mr. Pierce to have done? Or to put the question on a broader basis: what ought the investigator to do who is pursuing a special line of research in which he makes discoveries which he believes to be of real taxonomic importance? Two things at any rate we may agree he ought *not* to do. He ought *not* to be discouraged by the difficulty of the existence of such problems, nor by the attacks of carping critics, from pursuing the investigation to its furthest limits; and he ought *not* to conceal, in the hope of conciliating other workers, even the smallest fragment of the results at which he arrives. I have so often spoken and written in advocacy of specialism and of absolute faithfulness to evidence in matters of first-hand research, that I need not labour either of these points, and I have nothing but praise for Mr. Pierce's new volume in these particulars. There remains simply the question of *method of presentation*. The possible ways of bringing one's results clearly before the public appear to be: (1) To re-group without really re-classifying; *i.e.*, to show that according to the organ studied such-and-such species are associated, and so on, the species still being called by their current binomial appellations; for instance—to give

one actual case—"Group 26 (of Pierce's Geometridae) consists of *Fidonia carbonaria* and *limbaria*, *Strenia clathrata*, *Thamnonoma vauaria* and *brunneata*, *Macaria liturata*, *notata* and *alternaria*." (2) To re-classify absolutely by the one character, treating each group as a genus and assigning to it the correct generic name. (3) To re-classify by grafting the new system on the latest or best previous one; *i.e.*, where the new results seemed to indicate the division of one recognized genus into two or more, to effect such division, with the needful change in the nomenclature; but where they seemed to indicate the merging of existent differing genera, or of constituents thereof, not to disturb them unless the existent differentiation by other characters could be shown to be inadequate. (4) To graft some remnants of the old system on the new; *e.g.*, in the case of the *Macaria* group, which I have quoted above, to make the whole one "genus," or primary division, but to subdivide it according to the previously used characters.

It is right to say that Mr. Pierce conferred with me on the question of these alternatives, and was not unaware that each had its drawbacks, but felt that the second best suited his purpose and most fully met Mr. Tutt's criticism. The third, which would have been the ideal method, was not considered practicable; it would at least have necessitated either that Mr. Pierce should be a specialist in the *Geometridae* as well as in the genitalia, or that the book should have been brought out under the joint authorship of Pierce and Prout—for which the latter is fain to admit he was not ready. The fourth alternative would have presented nearly the same difficulties as the third, and would only have been, as a sort of compromise, inferior to it. The first course—re-grouping without re-classifying—was approximately that which Mr. Pierce essayed in his volume on the Noctuidæ and for which he was somewhat severely taken to task, but I cannot help thinking he in part missed the main point of the criticism. I cannot believe that Mr. Tutt, or any other experienced systematist, could have wished that each investigator of a single structure should apply an independent system of classification and nomenclature, ignoring the work of other investigators; this would be a negation of the "true specialism" of which Dr. Greenwood in this room has given us so sound a conception (*Rep. North Lond. Nat. Hist. Soc.*, 1911, p. 16): "True specialism, I think, means not to neglect other sciences or subjects, but to make their study ancillary to, and illustrative of, the chosen branch." There is even positive evidence that Mr. Tutt was strongly averse to one-sided classification; not only in the pains which he took, in his own "*magnum opus*," to avail himself of the co-operation of specialists of every kind and grade, but also in his animadversions on Meyrick's really valuable work, which failed only from this very cause—re-classification based on too few characters. I can therefore safely assume that what Mr. Tutt would have wished of any of us who had made taxonomic discoveries through the study of a single organ, is that we should show the re-grouping faithfully and fearlessly and in some form that would render its general results intelligible to the non-specialist; and that it should be left to the few—men of broad

philosophic insight, good general biological knowledge, and reliable mental balance—to correlate these various contributions and work out a re-classification which gave to each its due place. And I am constrained to add that here again it is our binomial system of nomenclature which is the great trouble. But for it, Mr. Pierce could probably have given satisfaction all round; it is the *objects*, and not their names, that interest him and all other morphological workers, and if each single animal had a single name we could shuffle them up again and again and make them into packets, so to speak, according to the progressive results of our researches, just as easily as he and his collaborator, Mr. Burrows, have often done in my presence with their photographic preparations or drawings.

After all, it is pretty clear that this is what will practically have to be done with Mr. Pierce's invaluable book; his *groupings* will be studied, and will in very many cases be found trustworthy and incorporated into systematic entomology; but this could and would have been done quite independently of the system of generic names—although as I am responsible for nearly all the names which Mr. Pierce has used, it is only fair to him and to myself to say that they are as nearly as possible the ones that will be applicable *if we decide that this classification by genitalia alone is to be the accepted one.* Similarly, if another investigator monographs the palpi of the *Geometridae*, I can, from my bibliographical researches, furnish him with the correct generic nomenclature for *his* groups. But what is the "man in the street" to do if we get a number of these monographs? Must all be divided into small camps, each with its own nomenclature? Must one say "*Macaria*, Meyrick," or "*Macaria*, Pierce," or *Macaria* "someone-else" every time one speaks of a genus? Or shall the individual preface his communication or his magazine article with the words "I am a neurationist," or "a genitalist," or "an antennist"? I leave you to give your own answers.

It has often been on my mind that this chaotic condition of genera in the Lepidoptera, and especially the fact that so many of them are badly or one-sidedly founded, must have an especially disastrous effect on such studies in geographical distribution as those, for instance, in Alfred Russel Wallace's classic "Island Life," or the works of Speyer, Koch, Pagenstecher, and other lepidopterists. I would far rather submit to Tutt's over-minute genera than to those which indicate no dependable genetic relationship. I touched on the point a few minutes ago in stating what is my own ideal in generic revision, but I desire to emphasize it. More than once I have had to deal with "genera" which Meyrick says are confined to New Zealand and the Palæarctic or to New Zealand and the Holarctic Region, and have found such material divergence in characters, which have been ignored by Meyrick, that I can only conclude their similarity in neuration and a few other points of structure is due to convergence merely, and that it would be at least very precarious to base any zoogeographical generalisations on the supposed evidence. Examples could be multiplied. Species of *Ouraptery.x* and *Abraxas*, for instance, have been described from South America by describers ignorant of structure, and misled merely by

general superficial similarities; a compiler who is not a specialist, however excellent a general zoologist, will more likely than not gather these records and schedule the genera I have named among those common to the Palæarctic and Nearctic Regions. The only hope is in the directions which I have reiterated with, I am afraid, almost wearisome insistence—specialism *plus* co-operation. Our compiler's work will, I am convinced, be nearly worthless, at least as regards the *Lepidoptera*, unless he have within his reach a complete staff of specialists to check his labours.

I had intended, in conclusion, to devote a short section of my address to one other aspect of our subject of specialistic studies and their scope; but I have found so much to say on the vexed question of generic groupings that time warns me it must be very brief indeed. I have reserved to the end the quotation of the full title of Mr. Pierce's monograph, which runs: "The Genitalia of the Group Geometridæ of the Lepidoptera of the British Islands." I spoke, in opening, of the fact of any memoirs "dealing exclusively with a particular structure in a particular group of organisms" as "at once its strength and its weakness." It is not in any spirit of carping or of "crying for the moon," that I now add the superimposition of another limitation, the faunistic, is a more obvious source of weakness, only to be borne with on the grounds of dire necessity. When one is dealing with so obviously compact a genetic group as the *Geometridæ*, one suffers far more from ignoring exotic forms than from ignoring homologous structures outside the family. I am so profoundly grateful to Mr. Pierce for the valuable work he has done that I would scarcely venture to mention this at all, but that I know that he, too, feels it. At times I have had the privilege of providing him with extra-British material, which has helped his investigations, and I would willingly have provided and he willingly have utilized much more, but for the inexorable question of practicability. To deal adequately with the genitalia of the *World's Geometridæ*, even so far as they are yet obtainable, would be more than one man's lifework; to prove which I need only tell you that of the "Emerald" sub-family, of which we have eight in Britain, I have catalogued about 1,500, and the number is constantly being augmented. The alternative—to monograph, for instance, the genitalia of the world's Emerald Moths, which would have appealed more to my specialistic ideas, would have been impracticable on account of the enormously reduced appeal of such an undertaking to the British (and European) entomological public. I can only add that both Mr. Pierce and Mr. Burrows are always most kind and helpful whenever I approach them on this matter, and that I hope to live to see at least a few genera of my favourite family dealt with in this exhaustive way.

THE CITY OF LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY.

(Read January 6th, 1915, by A. W. MERA).

At the request of some of the members of the North London Society I will endeavour to give a brief sketch of the history of the City of London Entomological Society, which has now become part of our newly-named London Natural History Society.

The Society, which you have now joined hands with, dates back to the year 1858. It then consisted of a small number of Entomologists chiefly residing in the neighbourhood of Haggerston, and was called the Haggerston Entomological Society. I was told by my late friend, Mr. J. A. Clark, that the first meeting place was at the Carpenter's Arms, Queens Road, Dalston, and after a few years the Society removed its meetings to the Brownlow Arms, Dalston, where it continued to thrive for many years. In those early times the Society was sufficiently well-known to attract to its meetings such well-known Entomologists as Doubleday, Stainton, E. Newman, S. Stevens and Dr. Knaggs, and a number of well-known professionals, including Cooke, Ashmead and Meek.

The meetings at the Brownlow Arms must have continued up to somewhere about the year 1888, when the title of the Society was altered from the Haggerston Entomological Society to the City of London Entomological and Natural History Society. I was not a member during the Brownlow Arms period, but I went once as a visitor, and the meetings were held in a large room over the bar. Each member was provided with a long clay ; it was customary to call for refreshments from below, and under those soothing influences the science of Entomology was discussed.

After a time, with the advance of the temperance movement, it was thought advisable to sever the connection of science with alcohol, and other rooms were found. This change did not appear to meet with universal approval, as some of the members went off to other societies, but the main body took rooms at the Albion, London Wall. About this time I joined the Society ; I should say from memory that it was about the year 1889. At the first meeting that I attended the habit of requiring sustenance during the meetings had not entirely died away, as one of the members present proposed to adjourn the meeting for half-an-hour or so to procure refreshments, much to the annoyance of the president, the late Mr. J. A. Clark. During the year 1891 the meetings were held at 33, Finsbury Square, and it was in that year we first published our yearly Transactions, which have been continued to the present time. At this period our Society took a decided step forward, and it was then that the influence of the late Mr. J. W. Tutt was most noticeable, he being vice-president.

The following year we were fortunate in obtaining rooms at the London Institute, where we had a most commodious and comfortable

meeting place, which we uninterruptedly enjoyed until about two years ago, when the London Institute was taken over by the Government, and from that time our tenure was only monthly. This in some ways created a feeling of uncertainty, and probably added to the falling off of our attendance.

In the autumn of 1895 the late Mr. J. A. Clark retired from the chair in favour of the late Mr. J. W. Tutt, after being president for eight years. Mr. Clark was one of the old school of British Lepidopterists, and he amassed one of the finest collections of his day. His interest in the Society never ceased.

Another member who was always associated in our minds with Mr. Clark was the late Dr. Sequeira. He was one of Mr. Clark's most intimate friends, and the two invariably came to the meetings together. The Doctor survived his friend by some years although he was considerably the older of the two. Unfortunately in the last few years of his life Dr. Sequeira became quite blind, but he never lost his interest in our Society. He was a man of extraordinarily cheerful manner, which never flagged to the last.

For the next three years, 1895-6-7, the chair was held by the late Mr. J. W. Tutt, and every Entomologist knows what weight his name carried. It is hardly necessary to say that under his Presidency the Society flourished, although apparently there was no marked increase in the attendance, as during the years he was Vice-President the Society had already felt his influence, and great progress had been made.

It was generally acknowledged that Tutt in his earlier days had immensely added to the interest in Entomology, which about that time had shown some signs of flagging, but the great interest which he took in the Noctuæ and their varieties created a new stimulus in collecting. He was also one of the first to insist on the necessity of having very long series of insects in our cabinets to show local variation. Until that time the very moderate number of six or eight specimens of a species was considered to be sufficient, but with the present wider views, it is very difficult to know where to stop, and the limitation often has to be decided by the amount of cabinet room which our domestic circumstances will permit.

After Mr. Tutt resigned the chair, the Society was favoured by our present distinguished president holding office until the end of 1901, and in 1902 I was elected president, and held the office until our amalgamation. Perhaps the great fault of recent years has been that we have been too much lepidopterous. Although the study of lepidoptera seems almost inexhaustible, largely owing to the vast amount of local variation to be observed, to say nothing of the remarkable increase in the growth of melanism in the British Isles, yet the life histories of so many of our indigenous species have been so thoroughly threshed out that much of the incentive to hard collecting has been removed. Nevertheless the born naturalist still finds keen pleasure in accumulating specimens of great beauty, which will also probably call to mind many pleasant associations.

With our new partnership I fully believe that there will be room

for all true lovers of nature, and our sphere of knowledge will be greatly widened by meeting with specialists in so many other branches of natural history.

As our worthy president is well-known to both Societies I feel confident that nothing will be left undone by him to assure the permanent success of our united Society.

NOTES ON BREEDING AND COLLECTING THE "SESIA."

(Read February 17th, by L. W. NEWMAN, F.E.S.)

When selecting this family for my paper I did so in the hope that my experience might help some of our members who have not taken certain species, to be able to do so in the future.

One naturally connects this sunshine loving family with a hot June or July day, but in order to get a fine series you need not wait for this. Most of my Sesia have been collected and bred in November, December, January, and Feburary, so there is no reason to be idle in the winter.

We will first take—

Sesia Ova.—There is still a lot to learn about the ova of this family. Very few have been taken in situ. I have watched *Tipuliformis* ovaposit on the young twigs of red currant. The ova of this family, as far as I have observed, are of a brownish colour and rather flat. In the case where a tree is the food-plant, the ova are usually laid on the bark or twigs, but in the case of *Bembeciformis* (*Crabroniformis*) the ova are laid on the leaf, and in *Apiformis* they are dropped loose at the foot of poplar trees.

The Larvæ.—These are usually of a dirty white colour with a brown head.

The Pupæ.—In colour these run from a light to a rich brown with strong hooks to enable them to climb up the boring—just previous to emerging the pupa shows very distinctly the colour of the Imago,

Ichneumons.—All the Sesia larvæ are badly stung as a rule. The ichneumon has a very long ovapositor.

Attacks by Birds.—Some Sesia seem exempt from the attacks of birds. I have never seen any sign of *Andreniformis* sticks being touched; other species, notably *Culiciformis*, seem the favourite winter food for the "tits." I have seen stumps of birch almost torn to pieces by their attacks. The cut off stump I have exhibited to-night is a good example. *Bembeciformis* is occasionally attacked; some years ago I knew a sallow bed which swarmed with these larvæ, nearly all of which had gone up the sticks some 8 to 10 inches from the stump; I collected a quantity in the winter and there was no sign of attack by birds, but in the early spring when I visited the locality almost every larva had been pecked out. The bird must have been the wood-pecker, I fancy, as some of the stems attacked were as thick as one's wrist, and it must have been a laborious task for the bird to peck right into the centre.

We will now proceed to *the methods of collecting larvæ*, and although

my notes may help you a little, you will find, as in a great many other things, experience is your best teacher.

Collecting Sesia Bembeciformis (Crabroniformis).—I have found this species in great profusion in the stems of *Salix caprea*, as many as five or six larvæ in one stem of good size; they also feed in the trunks of various sallows, willows and poplars. The larva makes a cap like *S. andreniformis*, but one seldom finds it with the cap intact, as a rule there is only the hole to guide you. A good plan in searching is to pull at the stems hard, and if there is a larva there the stem usually break away. I have also found them in quite small dead sticks about the size of one's thumb. By far the easiest method is to find a wood where the men are cutting the undergrowth in the winter and to examine the ends of all sallow cut, you will then find plenty, as a rule, with a hole in the centre; you can split up the stick to see if your prize is there and then tightly bind up the split end again. Be sure and cut the stick off about eighteen inches long, as very often the larva bores up a good way.

This species sembles very freely if the sun is out from about 9.30 a.m. onwards. The imago emerges from the pupa early in the morning from 7.30 onwards.

Sesia apiformis.—Collecting the larvæ of this species is a mistake as they are very hard to rear if taken in the larval stage. The larva spins a very tough cocoon in the autumn and remains in it all the winter and until it pupates. The cocoon may be found under the bark close to the ground of black poplars; it also sometimes comes out of the tree and pupates in the earth at the foot of the tree, but in any case the results are usually poor if you take the cocoon during the winter—it is best to wait till the larva has pupated. By far the easiest way to obtain this species is to visit the trees about 7 a.m. and take the moths drying their wings on the trunk or grass at the foot of the trees.

It is very easy to see where this insect is common as many trees have a hundred or more old holes just above the level of the ground. A row of trees near my house was almost killed by this species mining round the base and they were cut down. Unfortunately, I did not know *Apiformis* was at Bexley till I saw these trees felled and examined them.

Sesia sphegiformis.—Birch and alder are the foods of this species. It is common, but local, and is very destructive to trees. Whole acres of wood have been known to have been killed by the larvæ; this I believe happened in Wales. The larva is two or three years feeding up. It starts low down entering the young stems at the base after the trees have been cut, and bores right up the centre. The full-fed larvæ may be looked for in about the third years growth of underwood; frass is seen at the base of the stems as a guide.

The larva does not make a conspicuous cap, but it eats all but the thin outer bark away at its emergence hole, and its exit may therefore be found by gently feeling up the stem and pressing with the nail. In collecting, sticks about eighteen inches long should be cut. The imago sembles freely in the sun about mid-day.

Sesia scoliæformis.—The larva is found in trunks of old birch trees, but occasionally in large branches near trunk. When young it is near surface and its presence is indicated by frass, but when older it works its way into more solid wood about one inch below surface, making a burrow of a fair length running parallel with the surface of the trunk and *away* from the place where it originally began its borings.

When full-fed the larva gnaws its way to the surface of the trunk, leaving only a very thin covering of bark at the mouth of its burrow. It then makes a cocoon of small pieces of wood which is *tough*.

There is a "cap" at the end of this cocoon from which the pupa will force its way when the imago is ready to emerge. This "cap" is not firmly attached to the remainder of the cocoon and would be easily displaced by the pupa. The pupa next breaks away the "cap" of thin bark at the mouth of the burrow and wriggles its way out until about one-third of its length is exposed. The imago shortly after emerges leaving the empty case sticking out of the trunk. You may find these pupa cases any height from ground up to five feet, sometimes as high as nine feet. The imago emerges in the morning from seven to ten o'clock.

Sesia andreniformis.—Until its food plants *Viburnum lantana* and *opulus* were known, this insect was one of our greatest British rareties. It is now to be found almost everywhere where the food plant grows, though ichneumons are fast exterminating it in many localities. I know myself of two hedges over a mile in length with thousands of *Viburnum* bushes in them and hundreds of old borings, but not one of recent years, though no stick has ever been cut there; this will show the devasting influence of the ichneumon.

The larva of *Andreniformis* takes three years to mature. The *1st year* they feed just under the bark only; the *2nd year* they bore into the centre of the stick and feed on the pith going about one inch up the stick. The *3rd year* they enlarge the boring and go higher up. (The total length of the boring is only two and a half inches.) In the late autumn of the 3rd year they come down the boring and make a neat round "cap" just where the baby larva entered the stick. Let me here beg of you not to commit murder when collecting this species, by this I mean do not collect immature larvæ, but only the sticks with a "cap." If you take the larvæ in its earlier stages you will only lose them, as they soon die if out of the growing tree.

There is no special place to look for this species—any dusty old roadside hedge seems as good as nice clean bushes out on the open down. I have even taken them freely in the centre of dense woods where the sun could not reach the bushes, or where the bushes could only get occasional glimpses of the sun.

The ♀ does not select any special part of the tree to deposit on. I have cut sticks with the "cap" one inch above the ground and 14 feet up the tree—some sticks as thin as a pencil others as thick as my arm, so there is really no special place in the tree to search—all you have to do is to use your eyes well.

Birds do not appear to attack this species in the larval stage, possibly on account of the nasty smell of the wood.

S. tipuliformis.—This very common species is well known to most of us, and in June, on a sunny morning, if we look soon after breakfast on our currant bushes we are nearly sure to see freshly emerged specimens sunning themselves on the leaves, and a search of the twigs will show the empty pupæ case protruding. If you want some fun, box some freshly emerged virgin females, place them in a box with a muslin cover over the top and pin up on a currant bush. From about mid-day till 3.30 p.m. males will semble in great numbers; the sun must be bright of course or the males will not fly. I have taken over 100 in this way in a few hours in a currant field not far from my house.

The larvæ are not easy to find, but by a careful search they may be found best by pressing hard the young twigs. Those containing a larva feel soft, as the boring is a long one and weakens the twig a good deal; they also feed in the large stems as well as the young twigs. Tom-tits are very expert in finding the larvæ in my garden.

S. cynipiformis.—To find these larvæ you must first discover a spot where oaks have been felled the previous May; then any time during the winter larvae may be collected, or pupæ in May and June. Search the old stumps till you see frass between the bark and the wood. When this is found a chisel and mallet only are required. Insert the chisel about two inches below the top of the stump and work upwards, stripping off the bark till you come to the larva in its cocoon. If you work from the top of the stump you are very apt to cut the larvæ.

S. myopiformis.—Larvæ of this species may be found by chipping off the bark of old apple trees; they also feed on hawthorn. The larvæ feed between the bark and wood and do not enter the solid tree. The only sign to go by is the frass.

This insect is extremely local, often only *one* tree in an orchard or garden having any in it. It is usually abundant in its special tree however. I have seen over 100 pupa cases sticking out of an old tree at Bexley and have sembled a great many ♂s from 11 a.m. onwards.

They emerge from the pupæ about 8 a.m.

S. culiciformis.—This is by far the commonest Sesia in my district and is doing great damage to our woods; hundreds of stumps which should have thrown up nice undergrowth have been killed.

There are several methods of collecting this larva; they are always found where the birch or alder has been cut the previous winter.

Method I. Cut off with a sharp saw the old stumps as near the ground as possible. This is rather an arduous task, but pays well as a rule, for often thirty or forty may be be bred from the one large stump.

Method II. Search all the young growth coming up from old stumps, give each piece a pull and the ones containing a larva will usually break off easily. A good percentage of larvæ leave the stump and bore up the sticks. Examine all dead sticks on the ground round the stump, as often those containing a larva break off with the wind and lay on the ground. There is a boring going up the centre of a stick containing a larva also there is sometimes a "cap" similar to *Andreniformis*.

Method III. With a chisel and mallet start to get the bark off the stumps, work from the bottom upwards. A few larvæ will be found in their cocoons between the bark and solid wood, but most are right in the solid wood and usually near the top of the stump. When you come to a hole going into the solid wood, follow it till you come to the larva. When chipping it out try and get the cocoon intact in a piece of wood. This is not always possible, but often you can splice two chips together containing the cocoon. All loose larvæ should be brought home in saw dust (take a little with you in chip boxes).

S. formiciformis.—This is the clearwing which so far I have not dropped upon successfully in any numbers. I have bred it from a large stump containing *S. bembiciformis* and also found it in small twigs, in both instances in *Salix caprea.* Osiers are its favourite food. It used to be common in an old osier bed at Mitcham, Surrey, but this bed has long been done away with. It appears to make no cap.

S. ichneumoniformis.—This feeds in the roots of *Lotus corniculatus* and may be found by the withered appearance of the crown of the plant. Careful digging will capture the larva and the roots should be planted in damp sand with the crown of the plant on a level with the sand. It is fairly abundant on the Sussex Down, also on some of our Kent hills.

S. philanthiformis.—Usually common where its food (thrift) is abundant, more especially in Ireland, Wales and Cornwall. The larvæ feed in the roots and crown of the plant and cause it to wither. The plant can be dug up and kept moist and the imago easily reared. This species sembles in great numbers about midday.

S. chrysidiformis.—I regret to say that this most beautiful insect is almost exterminated through the over collecting of certain people. Folkestone Warren is its haunt and it feeds in the roots of dock and sorrel. Unfortunately there is hardly any dock to be seen there now. It has all been dug up and taken away in the hope of breeding this fine fly. It may still be found in very small numbers in the roots of sorrel.

The Warren is supposed to be its only locality in Britain, but I am glad to say this is not the case. My friend, Mr. Hills of Folkestone, knows another locality for it, but we hope it may not get well known, so that this fly may breed and multiply and the Warren could then be restocked.

I will now tell you some methods of **breeding Sesia** imagines in winter. We will take *Cynipiformis* first. Get a 7 lb. biscuit tin (or a smaller), in the bottom place two or three inches of sand which moisten well, now get a quantity of oak bark, not large pieces, one and a half to two inches square say, and pack these tightly together on the top of the sand ; make two or three layers ; now all you have to do is to place the larvæ in the tin and they will soon burrow into the bark and make new cocoons. Keep your tin (no lid on it) in a warm place (on a mantelpiece where there is a good fire regularly will do) and don't forget to sprinkle water (warm) over the bark every few days, so that the sand is kept moist, be careful not to drown the larvæ by putting too much

water. Forcing should not be started till after some good hard frost, and not before December.

In a good heat you may look for moths emerging in about 30 days from the time you started to force.

Sesia culiciformis.—Get a flat pan, an old baking tin is what I use, place in this about one inch of damp sand, lay the small pieces of wood containing larvæ on the sand, which damp in the same way as for *cynipiformis*, when your larvæ are in sticks plunge the end of stick in sand leaving emergence hole end standing up. When you have loose larvæ out of cocoons, proceed exactly as in *cynipiformis*, using, of course, small pieces of solid wood and bark of birch instead of oak, emergence will take place from 20 to 30 days after forcing commenced.

S. myopiformis.—Treat in the same way as *cynipiformis*, only use apple bark.

S. bembeciformis, andreniformis, tipuliformis, sphegiformis, formiciformis, all these being in twigs or stems all that is required is to plunge the ends in damp sand.

S. scoliaeformis.—The pupæ being collected in round or square pieces of bark all that is required is to lay these pieces on damp sand, under surface downwards.

S. chrysidiformis, ichneumoniformis, and **philanthiformis** being in roots of plants require planting in moist earth or sand with the crown of plant well out of soil.

To possess a really good series of each clearwing, if taken by oneself, means plenty of hard though interesting work.

It is a question, too, of great patience and perseverance, and if my listeners will only combine these two qualities and use their eyes, they will most surely be rewarded with some fine series of this very interesting family—the Sesia.

BRITISH BREEDING DUCKS.

(Read October 20th, 1914; written by C. S. MEARES.)

1. Introductory.

The "Anatidæ," including the British Breeding ducks, upon which I have been priviledged to address you this evening, are a family comprising the Geese, Swans and Ducks.

The expression "Duck" is a popular rather than a scientific term, including many sub-families separated by minor structural differences. "Goose" and "Swan" are but other terms embracing similarly distinct sub-families. All these sub-families rank, to all present intents and purposes, equally in the family "Anatidæ."

2. Species.

(*a*) *Geese.*

Of the Geese there are eight on the British list, of which:—

One only breeds in the British Isles in a wild state, *viz.*, The Grey Lag-Goose.

Five others are tolerably regular winter visitors, *viz.*, White-Fronted Goose; Bean Goose; Pink-footed Goose; Bernacle Goose; and Brent Goose.

The remaining two, *viz.*, Snow Goose and Red-Breasted Goose are very rare wanderers, and as they seldom come within the purview of sportsman or naturalist in the British Isles will be omitted from the scope of this paper.

(*b*) *Swans.*

All 3 Swans, *viz.*, the Whooper; Bewick's Swan; and the Mute Swan are winter visitors only, although the Whooper used to nest regularly in the Orkneys in the 18th century. In a semi-domesticated state the Mute Swan breeds freely throughout Great Britain, so much so as to cast considerable doubt on any truly wild record which might occur. The Wild Mute Swan, however, lacks the curved neck, and in flight lacks the creaking of the wings of the domesticated species; the neck is nearly straight, and the flight silent.

(*c*) *Ducks.*

The British Ducks number just over 30, of which 15 regularly remain to breed, *viz*:—

Sheld-duck	Teal	Scaup
Mallard	Garganey	Eider Duck
Gadwall	Wigeon	Scoter
Shoveler	Pochard	Goosander
Pintail	Tufted Duck	Red-Breasted Merganser.

One of these, the Garganey, is a strictly summer migrant, arriving in March or April, and leaving in September; in consequence it has aptly earned itself the name of "Summer Teal." This species, being the only purely British summer migrant of this family, is worth noting on that score.

One other, the Long-tailed Duck, has once been recorded to have bred in the British Isles. In winter it is of fairly frequent occurrence on our coasts.

Four other species of the Ducks are tolerably common winter visitors, *viz.*:—

White-eyed Pochard (or Ferruginous Duck); Golden-Eye; Velvet Scoter; and Smew.

The remainder are but rare Winter visitors or occasional wanderers, which also will be omitted from further consideration here.

3. Food.

A requisite closely affecting both the habits and distribution of this family is that of food supply.

(*a*) Geese.

All the Geese are mainly and primarily *vegetable* feeders.

The Brent Goose is a *coast*-feeder, eating aquatic grasses and plants, especially those exposed by the sea at low tide on the mudflats and ooze.

The remaining 5—The Grey-Lag, White-fronted, Bean, Pink-footed and Bernacle Geese—feed principally upon grass, clover and vegetable matter which are sought *inland*, the Pink-footed Goose having a distinct partiality for grain, which it seeks on stubble fields. In passing it may be worth emphasising that the Bernacle Goose does not feed on barnacles, as its name might seem to imply.

With the exception of the *Bernacle Goose*, which feeds by *night*, all these geese feed while it is light, whether day-light or moon-light. It is for this reason that the state of the moon is so important a factor in "flight" shooting.

(*b*) Swans.

All 3 Swans feed by *day* in fresh or salt waters or ashore, and are entirely *vegetable* feeders.

(*c*) Ducks.

In their mode of feeding, the Ducks may be classified into two groups :—

(i.) Surface-feeding Ducks,
(ii.) Diving Ducks,

under which titles Mr. J. G. Millais has recently published a magnificent work in three volumes on this subject.

Of the twenty British Ducks under consideration :—

Eight are Surface-feeding Ducks, all of which are British breeders, and twelve are Diving Ducks.

(i.) *Surface-Feeding Ducks.*

The Sheld-duck, the first of the surface-feeders, is essentially a *coast* dweller and seeks its food by *day*, eating sea-weeds, mussels, molluscs, and crustaceans, which it finds on the shore or on the sands uncovered by the ebbing tide, which it follows assiduously in its retreat.

Six others primarily feed in *fresh waters* or come on land to feed.

(*a*) Four of these, *viz.*, Mallard, Shoveler, Gadwall and Teal, are essentially *night* feeders, and seek their food *both afloat and ashore.*

The Mallard, Shoveler, and Teal take both vegetable and animal diet, ranging from grain and grasses to insects and worms, in fact eat nearly anything.

The Gadwall is nearly entirely *vegetarian.*

(*b*) The other two, *viz.*, Pintail and Garganey, seek their food nearly entirely *in* the water.

The Pintail, which eats both aquatic vegetable matter and insects, generally obtained from below the surface, feeds nearly entirely by *day.*

The Garganey feeds on fish and on other small *animal* matter such as water insects and larvæ, and during its sojourn here, which is mainly occupied with breeding operations, feeds by *day* in the morning and evening, as do all of the ducks during the nesting period.

The Wigeon, the last of the surface-feeders, mainly resorts, except in the breeding season, to sheltered tidal waters, but the presence of

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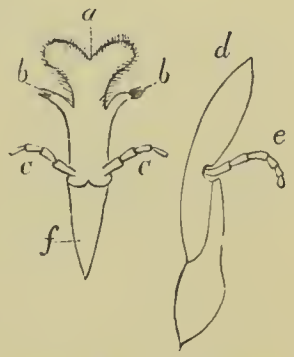

Tongue, &c., of Colletes (*Andrenidae*).
(*a*) Tongue; (*b*) Paraglossæ; (*c*) Labial palpi; (*d*) Maxilla; (*e*) Maxillary palpus; (*f*) Labium or mentum.

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flocks on inland waters in the sea-board counties is quite a common and usual occurrence. It feeds nearly exclusively on aquatic *vegetable* matter, which it seeks by *day* during the summer months; but as the days shorten on the approach of winter, it still seeks to maintain the hours of its morning and evening meals, and becomes in consequence a *night* feeder.

(ii.) *Diving Ducks.*

Of the twelve Diving Ducks, which obtain their food by diving, eight are British breeders and four Winter Visitors; but before reviewing their feeding habits in greater detail, a characteristic of this class should be carefully noted, *viz.*:—

That all the diving ducks have the hind-toe lobed, *i.e.*, there is a free web on either side of the hind-toe. In the Wigeon this same characteristic is developed in a lesser degree, but it is otherwise absent in the Geese, Swans and surface-feeding Ducks.

Both the wings and feet are used for diving propulsion; some species mainly use the wings, *e.g.*, the Tufted Duck; others the feet, *e.g.*, the Goosander; or in other families the Penguin and the Shag, which may be seen any day at the Zoo; but in cases of fatigue or urgency both wings and feet are simultaneously brought into play. Where the wings are used, ducks seldom expand them as in flight, but keep the tips of the wings pressed to the body, and operate them as it were from the shoulder to the metacarpal joint. The descent is either made diagonally against the current if in flowing waters, or not infrequently in a spiral.

Four of the Diving ducks freely haunt *inland waters* throughout the year, *viz.*:— Pochard, Tufted Duck,
White-eyed Pochard, Goosander,
although they resort to the sea as well.

The Pochard is a *night* feeder, eating mainly aquatic vegetable matter when on inland waters, but when at sea it feeds on crustaceans and molluscs.

The Tufted Duck generally feeds after twilight and before dawn, and includes fish in its mixed vegetable and animal diet.

With the exception of the two species just mentioned, all the diving ducks feed by *day*.

The White-eyed Pochard feeds both on vegetable matter, crustaceans and molluscs.

The Goosander feeds wholly on fish.

Three others, *viz.*:— Golden Eye
Red-breasted Merganser
Smew
are, excluding the breeding season, mainly sea-feeders, though their occurrence on inland waters is by no means rare.

The Golden-eye feeds largely on marine plants obtained by diving, which it generally brings to the surface to consume; it also eats crustaceans and molluscs.

The Merganser and Smew, like their kindred species the Goosander, feed wholly on fish.

The remaining five diving ducks are, except in the breeding season, exclusively sea-dwellers and *sea-feeders.*

The Longed-tailed duck is a *mid-water* feeder, catching marine insects and other small forms of animal life on which it mainly subsists, supplemented by marine weeds.

The Scaup and Eider are exclusively *sea-bottom* feeders, eating sea-weeds and particularly the smaller shell-fish, to which they are exceedingly partial. The Eider will take fair sized crabs, which it crushes to swallowing proportions in its powerful bill, and full sized mussels, which it is capable of swallowing and digesting whole. The Scaup, unequal to such feats, contents itself with smaller game of a similar type.

The Scoter and Velvet Scoter feed nearly wholly on crustaceans and molluscs.

To recapitulate:—

We have now divided the eight surface-feeding from the twelve diving ducks.

We have seen:—That the Brent Goose and Sheld-duck are exclusively coast-feeders, and five of the diving-ducks exclusively sea-feeders; points having an important bearing on their migrations.

That the Geese, except the Bernacle, the Swans, and the diving-ducks, except the Pochard and the Tufted duck, are day-feeders; and that the surface-feeding ducks are equally divided between day and night feeders; points of considerable importance to wild-fowlers.

That the Geese, Swans, Gadwall and Wigeon are nearly entirely vegetable feeders; and the sub-family Mergus entirely fish-eaters.

All the surface-feeding ducks, except the Sheld-duck, are palatable table birds when they have been feeding in fresh water, especially if taking a vegetable diet; but so soon as they are driven to the coast, or the salt water estuaries to feed, their flavour becomes strong and unsavoury. With the exception of the Pochard whilst feeding in fresh waters, all the diving ducks, particularly the sea-ducks, are disagreeable for table.

Before passing on, a structural point of interest is the bill, which differs very considerably in shape and formation in the different species; but a characteristic common to all the species of this family is the lamellation, or plating, of the inside edges of the bill, culminating in the sub-family Mergus, which embraces the Goosander, Merganser, and Smew, in a remarkable and ancient type of saw-like teeth, which are set pointing backwards.

The nail, or horny tip to the upper mandible, well exemplified in the Mute Swan, is another odd characteristic represented in this family, but confined to certain species only.

4. Range and Distribution.

In range and distribution this family is probably more widely represented than any on the British list, the Shoveler being the most widely distributed.

In several cases where the range of our British species ends, a nearly similar sub-species takes its place, *e.g.*, the Golden-Eye, where a

larger form, identical in plumage, takes its place in N. America, while in the Arctic regions it is represented by the nearly similar Barrow's Golden Eye.

Details as to the known distribution of individual species may be looked up from standard works on the subject, but a brief, if general, analysis of the breeding and winter ranges of various groups of species may help us to better appreciate a review of this family, since general impression is all too apt to regard them one and all as "coming from the North"

(*a*) All the six British Geese confine their general range to Europe and Asia.

Our British-breeding species, the Grey Lag-Goose, breeds in *Temperate* Europe from Iceland to the Caspian.

The remaining five which are our regular winter visitors, are *Arctic* breeders, choosing between Greenland, Iceland, Novaya Zemblya, Spitsbergen, and the mainland of Europe and Asia around the Arctic Circle, for their breeding haunts.

(*b*) The three species of Swans grade from Arctic to Temperate.

The Bewick Swan, as a breeding species, is strictly confined to Arctic Asia; in winter it visits most of Europe and temperate Asia.

The Whooper breeds in Iceland, and around the Arctic Circle in Europe and Asia; but not necessarily north of it.

The Mute Swan is entirely *Temperate*, the breeding headquarters lying in S.E. Europe and the Caspian regions, extending to Denmark and the South of Sweden.

In Winter both the Whooper and the Mute visit N. Africa, and all three wander to Eastern Asia.

(*c*) Of the Ducks—

(i.) Six are Arctic species, *viz.*, the Merganser, and the five Sea-ducks—Scaup, Long-tailed duck, Eider, Scoter, and Velvet Scoter.

The Scaup and Long-tailed duck breed in Northern America, where the Merganser also visits. The remaining three, *viz.*, Eider, Scoter, and Velvet Scoter are represented there by sub-species.

Southward the Merganser regularly visits the Mediterranean and N. Africa; while the five Sea-ducks more sparingly follow the sea-board to the Mediterranean, the Scoter occasionally following the larger rivers.

Eastward the Northern Pacific is reached by the Scaup, Long-tailed duck, and Merganser—the same trio which visit N. America.

(ii.) Seven others breed fairly evenly from South of the Arctic Circle to Mid-Europe, *viz.*, Mallard, Pintail, Teal, Wigeon, Tufted duck, Golden-Eye, and Goosander.

The breeding range of the Mallard extends also to the Mediterranean, N. Africa, and Central Asia.

N. America is visited by the Mallard, Pintail, Teal, and Wigeon though the Tufted duck does not seem to reach so far. The Golden-Eye and Goosander are represented there by sub-species.

Southward all these seven reach N. Africa—the Golden-Eye and Goosander sparingly, the remainder regularly.

Eastward they all range into Central Asia, visiting India and China, and the Pintail, Wigeon and Tufted duck appear to reach Malay.

(iii.) The remaining seven, *viz.*, Sheld-duck, Gadwall, Shoveler, Garganey, Pochard, White-eyed Pochard, and Smew are *Temperate*, breeding from about latitude 60 to Spain, the Mediterranean and the Caspian regions.

Outside Europe, the breeding range of the Shoveler extends over most of North America, and to North Africa. That of the White-eyed Pochard to Northern Africa and across Central Asia to Turkistan.

The Smew breeds from the Baltic eastward into Asia.

Both the Shoveler and Gadwall visit America and reach as far south as Panama.

Southward all these seven visit N. Africa, and the Shoveler reaches to Cape Colony.

Eastward all seven penetrate to Central Asia, the Garganey to Malay, and the Shoveler to Australia.

5. Breeding Habits.

Within the British Isles :—

(*a*) Geese.

The *Grey Lag-Goose*, which is gregarious, is now confined as a breeding species to Sutherland, Caithness, Ross-shire, and the Outer Hebrides; and there is an introduced colony in Ireland. In bygone ages it used to breed in Lincolnshire.

Somewhat curiously it avoids both the Orkneys and Shetlands, although it breeds in Iceland.

The nest is composed of flags, heather stalks, moss, or any soft material which comes handy in those barren regions, and is rather sparsely lined with "down." It is usually placed in a dry situation on an island in a fresh water loch among such vegetation, dead or alive, as the locality affords, or at the base of some stunted bush.

The eggs, laid from the middle to the latter part of April, generally number four or five, but at least seven are sometimes laid.

The males, during the period of incubation, swim about together on neighbouring waters, and at the approach of danger rise and fly "cackling" over the moors.

In Winter this goose is never very abundant, and prefers the coast lines facing the Atlantic.

(*b*) General.

(i.) *The "Down."*

All the species of this family from the commencement of laying and throughout the period of incubation accumulate a lining to the nest by shedding or plucking the "down" from their breasts, flanks, or chests.

The small fluffy tufts are known as the "down," and at this period of the year are so formed that the small tentacles adhere tenaciously

together when shed ; this is a peculiarity worth noting, since " down " plucked from a duck in winter does not adhere at all.

The small feathers, which are shed more sparingly and are usually to be found mixed up with the " down " in the nest, are known as the " flank feathers."

At first the " down " is mainly distributed round the rim of the nest, and as it increases in bulk spreads over the cup of the nest, forming a warm lining for the eggs.

In exceptional instances nests have been found entirely devoid of " down," even when incubation was well advanced.

(ii.) *Incubation.*

In all species of this family incubation is undertaken solely by the female, which during this period feeds twice daily, in the morning and evening, usually returning to the nest, though generalities are dangerous, about 9 a.m. and 5 p.m.

(*c*) Ducks.

(i.) The *Sheld-duck* breeds freely all around the British coasts where suitable conditions, such as sand-dunes, exist; sometimes a site is chosen a mile or two inland where the coast is not suitably adapted.

The nest is placed underground, generally in an old rabbit hole, often very deep and several yards from the surface ; others, in short burrows, are within easy reach and visible from the entrance. Where ready-made holes are lacking the bird digs its own burrow, which is constructed in the shape of an arc.

Very little material is introduced, just a few grasses and stalks, and the eggs are laid on the dry sand or soil ; as incubation advances, " down " accumulates abundantly.

The eggs, laid at the end of April or during the first half of May generally number ten to twelve. To watch the duck return to the nest after feeding is often quite an easy matter, and her nesting burrow may often also be detected by the presence of flecks of " down " around the entrance. During incubation, the males fraternise in the vicinity. The females join them at feeding time on the water's edge, and the males accompany them back to the nests.

When the young are hatched she leads them off to the vicinity of suitable feeding grounds, and must often carry them, presumably on her back, since she often takes them considerable distances over inlets of the sea, or over moorland to the sea.

In winter the numbers are not much augmented, since being a temperate breeder, the migration tends southward from the British Isles.

(ii.) The *Mallard* is generally distributed throughout the British Isles, and places the nest in a dry situation among grass, heather, or other herbage, according to the locality, often at very considerable distances from any water. Sometimes the nest is placed in the cavity of a tree, such as a pollard willow, and many unusual sites are on record.

Grass, flags, bent and similar material are used in the construction of the nest, to which "down" is freely added. When the nest is left, the eggs are sometimes partially covered with pieces of flags, etc.

The eggs, laid from the middle of March to early April, usually number from nine to eleven. The duck is a very close sitter, and is liable to desert if much disturbed. Throughout incubation the male keeps in touch with the female, joining her when she leaves the nest to feed; afterwards they will often fly round together, dipping as they pass the vicinity of the nest, until the female drops to it.

When the young are hatched, she takes them to sheltered water, where they feed on insects and anything else they can catch.

In winter the number of Mallards is largely augmented by migrants from the North and East. When the weather is severe they leave the frozen inland haunts, and resort to the salt marshes and estuaries.

(iii.) The *Gadwall*, normally a winter visitor, is confined as a breeding species nearly exclusively to Norfolk and Suffolk, where it was introduced some sixty years ago, and is now tolerably plentiful. A few odd pairs find their way to the Midlands, but they have not been recorded as breeding in Scotland so far as I am aware.

The nest, generally quite close to fresh water, running water preferably, and seldon more than a few hundred yards away, is placed in a dry situation among grass and sedge, sheltered sometimes by trees or a bush; sometimes it is placed under a large tussock or among heather on the open warren.

The materials utilised appear to be those which are most handy; grass, leaves, and pieces of reed when among sedge; pieces of heather when amongst it on the warren; in each case supplemented by "down."

The eggs, generally eight to eleven in number, are laid between mid-April and early May, the nests recorded at the end of May and in June being undoubtedly second attempts. The duck sits very closely, and is apt to desert on the least provocation. A distinguishing feature of both sexes of this duck is the large patch of white on the wings, clearly visible at certain angles when in flight; but when leaving the nest even at the closest quarters, this feature cannot always be clearly detected if the flight happens to be at the wrong angle for observation. During incubation the male remains near by, accompanying the duck at feeding time.

Lovers at all times of seclusion, the young are taken where the water's edge affords plenty of cover.

Even in winter this duck, except around its breeding haunts, is scarce, being a temperate species addicted to more southern migration.

(iv.) The *Shoveler* shows a great partiality to our eastern coasts, breeding plentifully from the Tay to the Thames, and although it breeds not uncommonly in Ireland, it seems to have no liking for the western sides of Great Britain or Ireland. A few breed in the Midlands, and it has been recorded up to Orkney.

The nesting site is usually in a tussock of grass, which the bird pulls well over the nest so as to completely cover it, on meadow land or marsh, in a dry situation.

The nest is composed of the finer grasses, plentifully lined with "down" in due course

The eggs, laid at the end of April generally number ten or eleven. The duck sits closely and deserts very easily. During the earlier stages of incubation the male accompanies the female at feeding times and drops her again at the nest; but as incubation advances, he leaves her altogether.

In winter the residents are largely augmented by numbers from the northerly brigade of this ubiquitous species, while many of our breeders go southward.

(v.) The *Pintail* is one of our rarer, though regular, British breeding species, and, apart from a small colony on an island in Loch Leven where they have received rigid protection, only a few pairs breed in Scotland, and a few nests have been recorded from Orkney, Shetland and the Outer Hebrides.

The nest, placed in, or under the shelter of a tussock of grass or rushes in some dry situation, is constructed of fine grasses, lined with small pieces of chopped up grass, with the usual complement of "down."

The eggs, usually eight or nine, are laid at the end of April. This duck sits closely, and shows little tendency to forsake her eggs. When disturbed during the advanced stages of incubation, she shuffles off her eggs, splashing them with excrement before leaving, and settles down again within a few hundred yards, repeatedly dipping her head as she watches the intruder. During the period of incubation, the males do not appear to remain in the immediate vicinity.

Regular migrations reach these islands in the autumn, but even in winter this species can hardly be called common.

(vi.) The *Teal* is commonly distributed throughout the British Isles as a breeding species, and places its nest in a dry situation among any sort of thick herbage, which generally forms a complete dome or covering to the nest.

The nest consists of flat grasses, pieces of flags, leaves, etc., or of heather, or other like materials according to surroundings, and is plentifully lined with "down."

The eggs, usually eight to eleven, are laid from mid-April onwards in the South, and in the North early in May. The duck sits very closely, and does not desert easily.

On 26th April, 1914, I witnessed a rather unusual incident:—A Teal, flushed from a nest containing eggs in a very advanced stage of incubation, after feigning broken wings, flew off and perched on a post in a wire fence; from this exalted position she surveyed the prospect for several minutes.

So far as I am aware, the male takes but little interest in the female after incubation has commenced.

In winter their numbers are considerably augmented by migrants, which distribute themselves over most of our freshwater meres. When disturbed they rise at a great pace nearly vertically from the water to a considerable height; and if shot at flying, the whole "wisp" often drop down vertically at lightning speed nearly to the ground before proceeding on their course.

(vii.) The *Garganey*, which we have noted as being a summer migrant only to the British Isles, is a rare and very local species. It breeds regularly in Norfolk, and has occasionally been recorded to have bred in other counties. To the West of England, Scotland, and Ireland it is only a scarce wanderer.

The nest, placed in a dry situation among marsh-herbage, or in a tusssock of grass on meadow land, consists mainly of grasses, lined with "down."

The eggs, usually eight to eleven, are laid in the latter part of April or early May. Nests containing fresh eggs in the latter part of May are probably second attempts. From their arrival up to the commencement of incubation the pair remain together, and sometimes small parties of some three to six may be seen flying round together in early April. So soon as incubation commences the male seems to part company from the female, which exclusively tends the young.

(viii.) The *Wigeon*, as a breeding species is nearly exclusively confined to the northernmost counties of Scotland; in Sutherlandshire it may be accounted common. The range of this species, however, appears to be extending southward, and nests have been reported from Dumfries-shire, Cumberland, Yorkshire, and Merioneth. No authenticated nest, so far as I am aware, has as yet been recorded from Ireland.

The nest is placed in a dry situation usually amongst heather, the prevailing cover afforded in the North, sometimes on a bank right by the water's edge, sometimes on the moorland slopes, or on an island of a fresh water loch. The materials consist mainly of heather stalks, lined with "down."

The eggs, usually eight or nine, are laid during May, generally towards the latter part of the month. I have taken a clutch of nine on 14th May. The duck sits closely, but is apt to desert if flushed from her eggs. At feeding times the male generally accompanies her.

In the autumn very large numbers of migrants arrive around our coasts, and the return migration takes place about March.

(ix.) The *Pochard* is a distinctly local breeding species; nests have been found in many counties from Orkney to Kent; but in Ireland, from which nests have been recorded, and in the West of England, it is rare as a breeder. Sociable in its nesting habits, some suitable localities such as are afforded in Norfolk and Essex are tenanted by quite a number of pairs, which flourish under protection.

The situation of the nest differs from that of all other species

under review in that the site is generally damp or wet. The nest, mainly composed of flags, is either a floating structure attached to reeds, or in thick rushes by the water's edge, much resembling the nest of a coot. The amount of "down" seems to vary considerably, but some nests are well supplied.

The eggs, generally ten to twelve, are laid from the end of April onwards, incubation commencing early in May. The duck is a fairly light sitter where nests are placed in open situations. The males keep company with the females even after the young are hatched.

In autumn migrants reach us westward from the Continent, and show a great partiality to returning to their feeding grounds of former years. Their flight is strong and rapid, and they dive splendidly.

(x.) The *Tufted Duck* breeds fairly commonly in many countries of England, Ireland and Scotland, which offer suitable sheets of water, even within the confines of London; but in Wales and the S.W. counties of England and Ireland it is rare as a breeding species. Many nests are often placed in close proximity, and the species is social in its nesting habits.

The nest, placed in a tuft of grass or among dead rushes in a dry situation, is usually quite close to fresh water, some island on a loch being a favourite site. It is constructed chiefly of grass, with pieces of flag, etc., and well lined with "down."

The eggs, usually nine or ten, are laid in the latter part of May or early June, and during incubation the males remain in the vicinity. After feeding, the duck swims back to the proximity of the nest and walks or flies thence to her eggs.

During winter a considerable number of migrants arrive on our lakes and estuaries.

(xi.) *Scaup.* The first authentic record of the breeding of the Scaup in the British Isles was a nest with three eggs found by Mr. Heatley Noble, on 14th June, 1899, in Sutherlandshire, which revisited a week later contained a clutch of nine. From 1897 to 1902 Mr. Harvie Brown subsequently recorded a few other nests from the Outer Hebrides. On 11th June, 1906, Mr. Bahr recorded another nest from South Uist with nine eggs, an account of which is given in "British Birds" of December, 1908. One or two nests have subsequently been recorded, but due to its similarity to the Tufted duck the species has probably been overlooked and may be a regular breeding species.

One distinguishing feature of the bird is the white patch on the forehead.

The nest found by Mr. Noble was placed in rushes five feet from the water on an island. That described by Mr. Bahr was also on a small island "situated in a deep hollow some nine inches below the level of the ground, and well guarded by large tufts of grass; a trampled

pathway led up from the edge of the water to the nest." Both the above nests contained a fair quantity of "down."

In winter the Scaup is commonly distributed around our coasts.

(xii.) The only record of the *Long-tailed Duck* having bred in the British Isles is a nest taken by a lad from Loch Stenness in Orkney, in 1911, when the birds were identified as being on the loch by competent observers. The nest was subsequently identified by the eggs and "down."

In winter this species is common in the North, though adult birds seldom come south of the border.

(xiii.) The *Eider Duck* nests abundantly in the Orkneys and Shetlands, and at intervals along the East Coast down to the Farne Islands, and breeds fairly commonly on the Inner and Outer Hebrides. The first breeding records for Ireland, where at all times it is rare, were from Donegal in 1912. This species is social, almost gregarious.

The nest, placed in grass or heather, is sometimes sunk and well sheltered, sometimes very exposed, and consists of grass, heather, or other easily gathered material, abundantly supplied with "down." Nests range from close above high-water mark on low lying islands to upwards of a mile inland on the upper slopes of islands at considerable altitudes.

The eggs, usually three or four, and very seldom exceeding five, are laid in the latter part of May. The ducks are tame and fearless, often walking off exposed nests when approached to a safe point of vantage, from which they unconcernedly watch results. Invariably and deliberately before leaving they cover their eggs with excrement, a habit which probably originated as a protective measure against the raids of the larger gulls.

When incubation commences, the males congregate in the nesting vicinity; and at night whole companies will keep up weird "coo-ing" groans.

Even in winter this duck seldom comes much south of its breeding range around our coasts.

(xiv.) The *Scoter* breeds in moderate numbers in the low lying areas of Sutherland, Caithness, and Ross-shire, and sparingly on the lochs at higher altitudes in Inverness-shire. The first Irish breeding record was the discovery of a nest with eight eggs by Mr. Trevelyan on June 13th, 1905, under a small bush on an island in a fresh water loch, where it has since bred several times. No nest has been recorded from Orkney, or elsewhere in Ireland, though there is some evidence of its having bred in Shetland.

The nest, often well concealed amongst rank heather at some distance from water, and often on an island in a fresh water loch, is composed of grass or heather, lined with "down."

The eggs, usually seven or eight, are laid early in June. When incubation commences the males leave the breeding vicinity.

In winter vast flocks visit the North Sea, the English Channel, and the ocean around the northern parts of Ireland, and a fair number may be observed off the remainder of our coast lines.

(xv.) The *Goosander* is tolerably common as a breeding species in the northern counties of the mainland of Scotland down to Inverness-shire, but is elsewhere rare.

Any convenient dry hole serves for its nesting purposes; clefts in rocks, especially those overlooking some loch, or forming the side of a ravine; holes in trees; or a hole in a peat bog. The nest is often placed several feet from the entrance where circumstances permit, and the same hole is tenanted year after year. As in the case of the Sheld-duck, flecks of "down" at the entrance, or clinging to the heather which shelters it, lend a clue to discovery.

The nesting materials consist of a few grasses or a little heather, occasionally a few leaves, placed on the dry soil, or sawdust, of the nesting cavity, lined with accumulated "down."

The eggs, ranging from eight to thirteen, are laid early in April. When incubation commences the males separate entirely from the females and return towards the sea. When the young are hatched, she leads or carries them to some neighbouring loch, and takes sole charge of the rearing of her brood.

In winter this species extends its range sparingly southward into England, but in the Orkneys, Shetland, the Hebrides, and Ireland it is at all times rare.

(xvi.) The *Red-Breasted Merganser* breeds commonly on the inland lochs and along the western sea-board of northern Scotland, in the Orkneys, the Hebrides, and on the lochs and around the coasts of northern Ireland.

The nest is placed well beneath the shelter of thick heather, rushes, or rough grass; in a rabbit hole, or other sheltered cavity in the ground. Island sites are often favoured, and the nest is generally placed in the close proximity of water. The materials are heather, pieces of rush, or grass, according to surroundings, lined with "down."

The eggs, usually nine or ten, are laid at the end of May or early in June. During incubation and after the young are hatched, the male remains in the vicinity of the brood.

In winter this species abandons inland water and betakes itself to the sea and tidal estuaries; around our coasts at this season it is generally distributed.

To recapitulate:

There are in this family four types of nesting site:—

(i.) That of the burrowing ducks, where the nest is placed underground, often in a hole excavated by the duck. This type is represented by the Sheld-duck.

(ii.) Those placed in natural holes or cavities in trees, rocks, peat bogs, etc. Of this class the Goosander is typical.

(iii.) Floating nests (of the Coot type), represented by the Pochard.

(iv.) Nests in dry open situations on the ground, sheltered to a varying degree by herbage, etc. This is the type of nest adopted by the geese, and the majority of our ducks.

Only two species are *strictly* confined to our coastal areas throughout the breeding season, *viz.*, Sheld-duck and Eider duck.

Eight species of this family breed north of the border only in Great Britain, *viz.*:—

Grey Lag-Goose, Pintail, Scaup, Long-tailed Duck,
Eider, Scoter, Goosander, Merganser,

and the Wigeon very seldom breeds south of it.

Two only are confined as breeding species to the south of the border, *viz.*, Gadwall and Garganey.

6. Eggs, Down and Flank Feathers.

A description of the eggs, "down," and flank-feathers presents considerable difficulties; but in so far as these three factors taken together furnish a nearly unimpeachable identification of the species to which the nest belongs, some attempt at definition, without illustration or exhibit, is excusable, if only on the grounds of inviting progressive criticism.

For preference the eggs, "down," and flank-feathers should be examined by day-light.

The first and only serious effort to deal with this subject was contributed to "British Birds" in two articles, in the June and July numbers of 1908, by Mr. Heatley Noble, entitled "Identification of Ducks' Eggs," supported by excellent full-sized coloured plates of typical flank-feathers of each species. Mr. J. G. Millais in his "Surface-feeding" and "Diving Ducks" pays an eloquent tribute to the accuracy and usefulness of these articles by refraining from further comment on this subject and referring his readers back to "British Birds."

The leading points incident to identification, supported by plates, differ, however, from a full descriptive narrative; and it is with the object of making some small advance in the latter direction that the following remarks will be directed.

The average measurement of the eggs of each species may be found in most standard works. Those of the "down" and flank-feathers where given are taken from specimens in my own collection, the selection being taken at random. The measurements are expressed in inches.

The measurements of the "down" have been taken from the centre quill to the tip; representing the length of the folded flake, or half the diameter.

The measurements of the flank-feathers represent the length from the very end of the quill to the extreme tip. The selection of flank-feathers was made solely from the normal small-type feathers, the occasional larger feathers which are sometimes present being ignored.

(*a*) *Grey Lag-Goose.*

Eggs :—Dull creamy white.

Down :—Very light grey-brown, with white centres.

Measurements :—1st nest ·9, ·8 ; 2nd nest 1·15, ·9.

Flank-feathers : —Pure White.

Measurements :—1st nest 1·6, 1·5 ; 2nd nest 1·7, 1·65.

The larger flank-feathers are slate grey, with a slightly burnished band across the top of the feather, tipped by a very narrow margin of white.

(*c*) (i.) *Sheld-duck.*

Eggs :—Polished creamy white.

Down :—Nearly white at the bases and tips, and blueish grey in the middle.

Measurements :—1·05, 1.

Flank-feathers :—There are two types :—

1. Pure white, with very dark brown, nearly black, tops.
2. Pure white, with chestnut tops.

Intermediary forms of feathers combining both characteristics are commonly found.

Measurements :—1·5, 1·5.

(ii.) *Mallard.*

Eggs :—There are two main types :—Creamy white tinged with green, and Drab green.

Down :—Light brown, with large dull white centres, and traces of dull white tips.

Measurements :—1st nest ·8, ·85 ; 2nd nest ·7, ·75.

Flank-feathers :—Web and base dull white. The ground colour of the upper portions is brownish grey, tending to burnished brown towards the tips. In the centre of the feather there is a light brown crescent extending *right across* the stem of the feather. Higher up, *well divided from the crescent*, there are two large semi-oval blotches of a rather darker brown, concave at the base, divided by and often meeting at the stem of the feather. Above these and well divided from them (except in the case of some of the larger types of feathers where they meet) a dark brown central marking, with its apex based on the top of the stem of the feather, widens out gradually and extends right to the tip of the feather, where the colour becomes more of a burnished sepia.

Measurements :—1st nest 1·6, 1·5 ; 2nd nest 1·7, 1·6.

(iii.) *Gadwall.*

Eggs :—Buff-white.

Down :—Very dark brown, almost dull black with rather dusky white centres, and conspicuous dull white tips.

Measurement :—1st nest ·9, ·9 ; 2nd nest ·75, ·9.

Flank-feathers :—White, of a slightly sooty appearance,

with rather faint dull brown markings above the centre of the feather. The web of the feather shows traces of brown.

(Mr. Noble's illustration depicts a dark central marking extending from the top of the stem of the feather to the tip—this feature does not appear in the flank-feathers of the nests which I have examined, nor does it appear to be supported by Mr. Noble in his letter-press.)

Measurements:—1st nest 1·5, 1·6; 2nd nest 1·65, 1·3.

(iv.) *Shoveler.*

Eggs:—pale creamy-white, tinged with green.

Down:—Light to medium brown, inclining to grey, with large dull white centres, and small dull white tips—closely resembling in colouration that of the Mallard.

Measurements:—1st nest ·7, ·8; 2nd nest ·6, ·6.

Flank-feathers:—The web of the feather is dull sooty white. The whole of the central portions of the feather are occupied by a large very dark brown horse-shoe, in the centre of which the light stem of the feather shows up clearly. From the margins of the brown horse-shoe outwards the sides and uppermost portions of the feather are of a burnished brown, the extreme tips sometimes shading off to a silvery white.

(The illustrations given by Mr. Noble are far from typical of the feathers in my collection.)

Measurements:—1st nest 1·15, 1; 2nd nest 1·15, 1·1.

(v.) *Pintail.*

Eggs:—There are two types, a light cream-green, and a light cream-brown.

Down:—Medium brown, very faintly tipped with white. Fairly large white, to dull white, centres.

Measurements:—1st nest ·8, ·75; 2nd nest ·85, ·9.

Flank-feathers:—Web dull brownish-white. Just below the middle of the feather there is a brown central marking extending across the stem of the feather, sometimes taking the form of a horse-shoe; this marking is in some feathers quite large and well defined, though in others it is hardly traceable. The dull white ground colour of the feather forms a band or horse-shoe above this lower marking. Higher still about two-thirds up the feather, a very broad band varying from dark to medium brown with a tendency to burnished margins extends nearly across the upper middle portions of the feather, while a similar but narrower brown band is thrown up from the centre of the cross band right to the tip of the feather, though the extremity of the tip sometimes shades off to dullish white. The two top angles of the feather (above the brown cross band and on either side of the upright

band) are white, sometimes a conspicuous silvery white, sometimes dull white.

Measurements:—1st nest 1·2, 1·2; 2nd nest 1·3, 1·25.

(vi.) *Teal.*

Eggs:—Creamy white, with a tinge of green.

Down:—Nearly black, with prominent silvery white centres, but *no* white tips.

Measurements:—1st nest ·7, ·7; 2nd nest ·75, ·65.

Flank-feathers:—The web and general ground colour of the feather are smoke-grey, dulled by faint traces of brown. The markings are of a medium brown, and fall into three groupings:—

(1) A band, or horse-shoe formation, across the upper middle portions of the feather, throwing up another central band towards, but *not* extending to, the tip.

(2) Two broad bands running up the centre of each side of the feather, parallel to the stem of the feather, but not reaching to the tips.

(3) An elongated inverted horse-shoe; the result of the two parallel bands above mentioned meeting towards the top.

Measurements:—1st nest 1·0, 1·1; 2nd nest 1·2, 1·1.

(vii.) *Garganey.*

Eggs:—Creamy white, without any trace of green.

Down:—Nearly black, with white centres, and very conspicuous white tips.

Flank-feathers:—Base, dull brownish white. The ground colour of the feather is greyish-white, with a conspicuous semi-oval large brown marking in the centre of the feather.

(viii.) *Wigeon.*

Eggs:—Cream white, with a faint to a pronounced tinge of buff.

Down:—Medium to dark brown, with small dull-white centres, and narrowly tipped with white.

This down is very similar to that of the Gadwall, but lacks all tendency to black.

Measurements:—1st nest ·8, ·85; 2nd nest ·9, ·8.

Flank-feathers:—There are two types:—

1. Pearl-grey to white; entirely lacking the dull brown central markings generally present in the Gadwall.

2. Feathers with the web, bases and the upper central portions light brown, bounded by a darker brown arc across and above the middle of the feather. The upper portions and margins of the feather above this arc are pure white.

(This type of feather occurs freely in one of the nests in my collection, but is entirely absent from the

other nest; it is neither described nor illustrated by Mr. Noble.)

Measurements :—

1. White feathers : 1st nest 1·3,1·3 ; 2nd nest 1·3, 1·3.
2. Brown feathers : 1st nest none; 2nd nest 1·, 1·1.

(ix.) *Pochard.*

Eggs :—Drab-green.

Down :—Dull sooty-colour, with small and very dull white centres, and no white tips.

Measurements :—·75, ·7.

Flank-feathers :—Web and lower portions of the feather smoke-grey, shading to a darker dull brown towards the tips.

Measurements :—1·1, 1·05.

(x.) *Tufted Duck.*

Eggs :—Creamy buff-green.

Down :—Very dark sepia-brown, but by no means black, with small brownish-white centres and no white tips.

Measurements :—1st nest ·75, ·7 ; 2nd nest ·9, ·8.

Flank-feathers :—There are three types :

1. Silver-grey.
2. Sepia-brown all over, nearly the same colour as the "down" ; rather darker at the tips than at the base and centre.
3. Sepia-brown feathers, with conspicuous white tips, or traces of white tips. These feathers come from the chest of the duck.

Measurements :—

1. Silver-grey Feathers :—1st nest 1·25, 1·2 ; 2nd nest 1·2, 1·25.
2. & 3. Sepia-brown Feathers :—1st nest 1·05, 1·15 ; 2nd nest ·9, ·9.

(xi.-xii.) The eggs, "down" and flank feathers of the *Scaup* and *Long-tailed Duck* I have had no opportunity of examining at close quarters.

(xiii.) *Eider Duck.*

Eggs :—There are two types, Olive-green, and creamy-grey with a tinge of green.

Down :—Dull smoke-brown, with small pure white to brownish white centres.

Measurements :—1st nest 1, ·8, ·85 ; 2nd nest ·9, ·9, ·6.

Flank-feathers :—Dull smoke-brown, darkening towards the tips, and sometimes broadly tipped with very dark brown. In the larger flank feathers the upper portions have a burnished brown ground colour, and are barred with black ; the lower portions of the feather fade away into smoke-brown.

Measurements :—1st nest 1·15, 1·35, 1·2 ;
2nd nest 1·35, 1·35, 1·4.

Flank Feathers.

a, Mallard; *b*, Shoveler; *c*, Pintail; *d*, Teal (1); *e*, Teal (2); *f*, Teal (3); *g*, Wigeon.

(xiv.) *Scoter.*

Eggs :—Buff-white.
Down :—Very dark brown, nearly black.
Flank-feathers :—Smoke-brown, fairly light at the base, and darkening considerably towards the tip.

(xv.) *Goosander.*

Eggs :—Yellowish buff.
Down :—Light pearl-grey; very much whiter than the down of the Sheld-duck.
Measurements :—·9, 1·.
Flank-feathers :—White generally tinged with traces of yellow. Sometimes there are small but well defined dark brown markings adjacent to the stem of the feather.
Measurements :—1·75, 1·65.

(xvi.) *Red-Breasted Merganser.*

Eggs :—Drab-green.
Down :—Drab-grey.
Flank-feathers :—White.

THE MIDDLE AGES IN THE WEY VALLEY.

(Read by E. CHAPMAN, on November 3rd, 1914.)

To-day, when Europe is aflame with a terrible war, the Middle Ages seem indeed a long way off, yet, in the war two deeds, the destruction of Louvain and the bombardment of Rheims Cathedral, have specially shocked civilised people largely because the Flemish city and the great French church were alike beautiful survivals from those times.

Since Gibbon wrote his wonderful survey, each generation has turned with increasing interest to the great stretch of the life of Europe which lies between the Fall of Rome and the Fall of Constantinople, to the period in the life of our own nation which lies between the coming of the monks under St. Augustine of Canterbury and the Dissolution of the Monasteries under Henry VIII. Gibbon saw in all this the decay and destruction of the stately Roman order that he esteemed. "I have described," he said, "the triumph of barbarism and religion." To-day we look with other eyes. We regard those ages, with differences of course, among ourselves, but with very different feelings from his. Where he saw the ruin of an Empire we see the rise of the nations, their slow transformation from wandering hordes into great civilised communities. For us, among the outstanding features of the Middle Ages are the rise and decay of monasticism, the long struggle between the Church and the State, the struggle between the Crown and the Nobles, with the accompanying rise of the middle class, the rise and triumph of a new architecture, a glorious art bringing the other arts in its train, the birth of democratic ideas, the beginnings of modern industry, of modern education, and of modern literature.

All these were broad movements common to every country of mediæval Europe. In this paper I should like to trace their effects, as they are illustrated in one little valley which has been my home for the last twenty years, the valley of the Wey, in Surrey.

Of the half dozen towns and some two score villages existing to-day in this area, nearly every one has grown up round a site chosen in the centuries before the Norman Conquest. They bear, so far as their etymology can be surely traced, English, and not Celtic or Roman names. Some, as Tuesley, Wanborough and Thursley, recall the gods worshipped by the first English settlers. But we have no light on the change from Pagan to Christian worship. In the tangled struggle for overlordship among the English chieftains, Surrey seems to have thrown off the rule of Kent in a battle at Wibbandune, a place which cannot now be identified with certainty. Then Mercia held sway here, and the county derives its name from this fact. It was the South Rey or kingdom—that part of Mercia which lay south of the Thames. Wulfhere, the second Mercian king from the great Pagan leader Penda, founded, or is said to have founded, Chertsey Abbey in 666. That is the first notice we have of any Christian foundation in the county. The dominion of Wessex succeeded, and brought Surrey, with so much else, into the common rule of the King of England.

The fact that Winchester was the first national capital had its importance for our valley, which lay on the road between Winchester and the great Mercian city that in the end was to supersede it as metropolis. The king and his bishop each had their stronghold at important points in the valley, and when, later, the two Norman castles of Guildford and Farnham, whose remains we see to-day, superseded these strongholds, the fact that they were held by the king, and the bishop who was all through so emphatically the king's bishop, preserved the valley in comparative peace and security. Only once, for a few days at the end of John's reign, did both castles pass into alien hands.

The Norman Conquest strengthened and crystallised the manorial system, which, here as elsewhere, had already grown up. The soil was for the most part poor, and very many of the manors had great wastes that were never brought into cultivation, a fact to which the district owes those commons which make it to-day so attractive to the rambler and the naturalist.

The king himself held many of the manors in his own hands. One of them, Pyrford, formed, with Battersea, the price he paid to the Westminster monks for their lands at Windsor. A result of this acquisition was that a large part of West Surrey was declared to be in the royal forest of Windsor, and was ruled for centuries under the forest laws. Questions of jurisdiction arose, and the afforested area was at length defined as all Surrey north of the road over the Hogsback and west of the Wey. In the extreme south-east of this area the king had his park at Guildford, and, further north at Woking, a manor house, which, under the last Henry, became a frequent royal residence.

The valley was so strongly held, and was so largely royal demesne, that the long struggle between Crown and Nobles left little mark upon it, but with the rise and decline of monasticism, and with the struggle between the church and state its history is closely linked. The documentary history of Surrey begins with a charter, probably a forgery, but a very early one, of Chertsey Abbey. The great monastic revival of the eleventh and twelfth centuries saw the reform of the Benedictine rule, and the foundation under an Englishman, Stephen Harding, of the Cistercian order. In 1128 the Bishop of Winchester brought over from France twelve monks of the new order, and gave them lands at Waverley by Farnham, where, under the renewed encouragement of successive bishops, they established a great abbey. The story of this abbey forms in itself a synopsis of the story of monasticism in England. We see the monks busy with their buildings, industriously cultivating the country side, raising great flocks of sheep on the neighbouring hills, entertaining great nobles and kings, for here in 1208 came John to spend four days of Holy Week, bringing with him two tuns of wine, no doubt to mitigate the severity of the Lenten fast, and here, in 1225, came the young Henry III., and was admitted to the confraternity in the chapter house. At this date the monks were in the midst of rebuilding ; they were replacing their first Norman Abbey with a beautiful Early English structure. The new church was

completed in 1230, and now the monks seemed at the height of their prosperity. In 1240, a young shoemaker charged with homicide took sanctuary with them, but after some months, was seized by the king's orders, and carried off to prison. The Abbot after a vain appeal to the Papal Legate, turned to the king himself, producing the charters and privileges of his order, convincing him " that the precincts of Abbeys and their Estates were by apostolical authority exempted from the encroachments of all wicked and profane persons, and inviolable as the altars of churches." The shoemaker was restored to the monks, the officers who arrested him were condemned to ask pardon at the convent gates, and afterwards to be publicly whipped, " which sentence having been fully executed upon them by the Dean of the House and the Vicar of Farnham, they were absolved in form, and, having a sufficient penance enjoined them, were dismissed."

Nor was this the only incident in the great struggle which the valley witnessed. Already in July, 1174, Henry II. had passed through Guildford on his swift penitential journey to Canterbury, after the murder of Becket, and in 1199, Ruald de Calva had founded, in honour of St. Thomas, the Austin priory of Newark at Ripley. The beautiful little church of East Clandon also dates from about this time and bears the same dedication.

Of the rise and development of mediæval architecture, the valley presents many interesting, but no very rich or famous illustrations. The district was not wealthy, and building materials were not of the best. But what a rural population could do with flint and chalk and Bargate stone, with tiles and Horsham slabs, and with here and there a shaft of Sussex marble, was done. Of the ancient churches the outer walls are mostly of flint, and the interior arcades very frequently of clunch—a hard form of chalk. Lofty towers and delicate traceries were alike out of the question. But of simple and sincere work, well adapted to its ends, much is left to us.

Of Pre-Conquest building there is little remaining, but the strong rude towers of St. Mary's, Guildford, and of Compton have been ascribed to this period with some confidence. Of the Norman period there are several interesting examples, including Compton with its unique chapel above the vaulted sanctuary, and its very ancient screen, the main structure of St. Mary's, Guildford, whose walls were enriched in the thirteenth century by paintings which remain, the royal keep of Guildford, and the tiny village church of Pyrford. Of Early English work the most notable remains are those of Waverley Abbey, the beautiful western doorway of Shere, and the great E. window of seven lights at Ockham. The architectural needs of the district do not seem to have undergone any great expansion in the fourteenth century. Here and there a fine new window was opened, as at Shere, but I do not recall any building wholly in Decorated work, and similarly the examples of Perpendicular work are mostly to be found in enlargements and modifications of older buildings. Then at the very close of our period, we see the needs of a new time finding satisfaction in two buildings, both instinct with the old Gothic beauty, the great manor house of Sutton, and the Grammar School at Guildford.

Throughout the mediæval period, the district depended for its economic life almost entirely on agricultural and pastoral activities. We have not much evidence for tracing the slow change from the old system of communal cultivation to the system of separate farms, but in the Lammas Lands at Godalming and the Broad Meads at Woking there are survivals of common pasturage. The stocks of wool raised by Waverley monks from their great flocks were no doubt a factor in the creation in the thirteenth century of a cloth industry at Guildford. For a time, Guildford cloth had a good reputation in the markets of Europe, but it is recorded that the reputation was lost by the greed of the clothmakers, who so stretched the cloth to increase its quantity, that the quality was injured. The meadow, where the cloth passed through this finishing process, still bears the significant name of Racks Close.

Another manufacture, which, like that of cloth, has passed away from southern England was that of iron. At Thursley and Abinger there were works for smelting the rough ironstone of the Greensand formation, but these were only outliers of the Sussex ironworks, and did not survive the general substitution of coal for wood in the furnaces. The ponds at Thursley, formed to provide the water power for the smelters' hammers, are still the Hammer Ponds.

Side by side with these industrial developments there had arisen in the little towns of the valley, as elsewhere, a desire on the part of the burgesses for some measure of freedom from their feudal lords. The thirteenth century, which saw such great constitutional developments in our national life, brought to Farnham and Guildford their first recorded charters. In 1247 the Bishop of Winchester gave to the burgesses of Farnham the whole manorial authority in the borough and town, reserving to himself the privileges of hue and cry, persons and chattels of felons, escheats of their lands and tenements, and the services of two or three of his chief tenants. In 1257 Henry III. gave to the "approved men" of Guildford freedom from arrest for debt as surities, unless they had clearly not done their best, freedom from forfeiture of chattels for defaults of their servants, and the right of heirs of intestates to their chattels. Such were the simple beginnings of municipal liberties. In the next century a far broader claim for freedom arose from the industrial population of south-eastern England stirred by John Ball and his fellows. Their so-called Peasants' Revolt in 1381 seems to have been more truly a revolt of the craftsmen of the towns. The constable of Guildford Castle, Sir Simon Burley, played a prominent part in the events which precipitated the outbreak. The arrest of one of his serfs, who had taken refuge in Gravesend, brought the angry townsfolk in full cry about the walls of Rochester Castle whither he had carried his man. Either during his absence or soon after his return, the Guildford populace rose against their lords, including apparently the "approved men," and held all the town outside the castle at their mercy. They destroyed the borough charters, following in this the example of their Kentish friends, for the rebels seem everywhere to have believed that it was by these charters and like

documents that their lords exacted their services. Thus it happens that the earliest muniments of Guildford are only copies of the 13th century charters, copies obtained from the crown after the ruthless suppression of the democratic movement.

With the rise of these new forces, monasticism entered on its final decay. In 1387, William of Wykeham visited the Priory of Austin Canons at Selborne, and severely admonished the convent for its worldliness, threatening it with dissolution. The abundant wild life of that lovely district among the head-waters of our stream, seems to have proved too strong a distraction for the holy men. That a Selborne cleric of a later day also felt its secular fascination is the joy of this and every Natural History Society. But in 1486 William's threat was followed by a papal bull dissolving the convent. So Selborne Priory was the first to go of the religious houses in the valley. For all of them the end was near. We spoke just now of Waverley in the days of its glory, when kings were its guests, and their servants did penance at its gates. How the world had changed when in June, 1536, this letter was handed to Thomas Cromwell :—

"To the right honourable Master Secretary to the King :

"Pleaseth your mastership, I received your letters of the 7th day of this present month, and hath endeavoured myself to accomplish the contents of them, and have sent your mastership the true extent, value, and account of our said monastery. Beseeching your good mastership for the love of Christ's passion to help to the preservation of this poor monastery, that we your beadsmen may remain in the service of God with the meanest living that any poor man may live with in this world. So to continue in the service of Almighty Jesus, and to pray for the estate of our prince and your mastership. In no vain hope I write this to your mastership for as much as you put me in such boldness full gently when I was in suit to you the last year at Winchester, saying 'Repair to me for such business as ye shall have from time to time.' Therefore instantly praying you, and my poor brethen with weeping, yes ! desire you to help them ; in this world no creatures in more trouble. And so we remain depending upon the comfort that shall come to us from you, serving God daily at Waverley.

"From thence the 9th day of June, 1536.

"William, the poor abbot there, your chaplain to command."

Alas for the weeping monks ! no comfort was to come to them from Thomas Cromwell. At St. Nicholas Rectory, in Guildford, he was next year signing the deeds of dissolution of all the smaller houses. In 1538 the Black Friars of Guildford, the only religious house remaining in the Valley, made their surrender. Outside, the free scholars of Robert Beckingham's foundation were playing on the broad slopes of the Town Ditch. The Middle Ages had passed away.

GYNANDROMORPHISM.

(Read December 1st, 1914, by E. A. COCKAYNE, M.A., D.M., M.R.C.P., F.E.S.)

Insects half male, half female have been known from an early period and on account of the great degree of sexual dimorphism in many of the Lepidoptera are especially conspicuous in this order. The term gynandromorphous or gynandrous was applied to them without regard to their internal anatomy. Indeed, the first dissection was not carried out until Rudolphi examined a halved specimen of *Gastropacha quercifolia* in 1825. Westwood drew attention to the less noticeable forms of gynandromorphism in his "Thesaurus Entomologicus Oxoniensis."

Ochsenheimer divided them into perfect and imperfect, and Lacordaire further subdivided them into

(1) Semilatéral (halved).
(2) Superposé.
(3) Croisé.

In addition he pointed out that in all three forms the sexual elements may be in equilibrium, but in the last two one or other sex may predominate to any extent.

A very elaborate classification was carried out by Dalla Torre and Friese but is most unsatisfactory. Many of their groups are void of examples and the great majority fall into two groups only.

The internal structures are very variable and classification based on them is not entirely satisfactory.

I have suggested the following arrangement:—

I. *Genetic Hermaphrodites.*

Primary sex glands of both sexes present.

(a) *Unilateral.* Ovary *or* testis on one side
Ovary *and* testis on the other.

(b) *Bilateral.* Ovary and testis on both sides
or ovarian and testicular tissue in the same gland on both sides (Zwitter drüse).

(c) *Lateral.* Ovary or ovaries on one side
testis or testes on the other.

II. *Primary Somatic Hermaphrodites.*

Sex gland or glands of one sex only, but parts of secondary sexual apparatus of both sexes present.

(a) Male type, one or two testes.
(b) Female type, one or two ovaries.

The gland or glands in both these groups may be perfectly developed, but a more or less rudimentary condition is common in the case of the ovary.

III. *Secondary Somatic Hermaphrodites.*

Sex glands of one sex only and secondary sexual apparatus of one sex only corresponding to the sex gland present. Secondary sexual characters of both sexes present in antennae, wings or other part of body.

(*a*) Male type. Two testes.
(*b*) Female type. Two ovaries.

The majority of gynandromorphous insects fall into group II., and relatively few into groups I. and III. Probably groups I. and II. are much more closely related than group III. Nearly all genetic hermaphrodites are lateral, and usually have one ovary and one testis, but both two sex glands of one sex may be present with one of the other sex, or two of both sexes may be present.

The Secondary Sexual Apparatus.

Very frequently where a sex gland or secondary sexual apparatus of one sex is present, a portion of that belonging to the other sex is also found. Usually only the lowest part of the tract is found in such cases, but sometimes the whole is present, though of course, in group II., without the sex gland itself. And in the external genitalia there may be a similar arrangement: a complete set of both male and female organs may lie side by side. In other cases the internal organs and external genitalia may be half male half female without any doubling, in others the organs may be almost or even wholly of one sex. Even in lateral genetic hermaphrodites the lower part of the genital tract of one sex may be absent, whilst that of the other may be wholly or in part doubled.

In all cases deficiency of internal or external structures is very common.

Occasionally a mosaic replaces the halved arrangement. Perfect halving is seldom carried to the external genitalia and only one example, that of Toyama's *Bombyx mori*, is known in which it has extended to the whole of the internal and external organs The appearances presented suggest that one half of the genital tract can give rise to a complete genital apparatus, so that, if one half of it is male and the other female, a complete double set of organs of both sexes is present including the sex glands themselves. Usually one side develops better than the other and often neither develops perfectly. On this view most primary somatic hermaphrodites and all lateral genetic hermaphrodites are of the same nature. Unilateral genetic hermaphrodites are more probably produced by a mosaic arrangement of the cells of the germinal epithelium and primitive genital tract, but they are extremely rare.

Gynandromorphism in Vertebrata.

Gynandromorphism has occurred in all the better known orders of Insects, Lepidoptera, Coleoptera, Hymenoptera, Diptera and Orthoptera and in various crustaceans and spiders. In addition it has been met with in birds, but only five examples are known. In four of them the halved arrangement was perfect externally and internally. They were lateral genetic hermaphrodites with a testis on the male and an ovary on the female side. The fifth a pheasant was similar except for some decussation of sex characters in the tail. In mammalia I know of no instances except four doubtful ones in man. The famous Karl or Katherina Hoffmann was probably a lateral genetic

hermaphrodite and undoubtedly showed some segregation of the secondary sexual characters of the two sexes, both physical and psychical, to the opposite halves of the body.

Garrigues states that he met with a perfect example in 1896 in America, but gives no detailed description or photograph.

The perfection of the halving in birds and in the lobster reported by Nicholls is of the utmost importance in considering the cause of the condition.

Gynandromorphism and Heterochroism.

In addition to a segregation of sex characters some insects show a segregation of somatic characters, colour or pattern, quite independent of sex. Some of these are halved and some show a coarse mosaic arrangement. In many cases one of these colours or patterns is a simple Mendelian dominant to the other. Examples of this are *Psilura monacha*, part type, part ab. *eremita*, *Hemerophila abruptaria*, part type, part var. *brunneata*, *Aglia tau*, part type, part var. *lugens*, and *Acidalia virgularia*, part type, part ab. *bischoffaria*. In all these and the many others known the parts showing type colour were of one sex, the parts showing varietal or aberrational colour the other. Larvæ of *Bombyx mori* have been met with showing melanic colour on the one half of the body and typical pale colour on the other. Where these have reached maturity the imago has proved to be a halved gynandromorph. One example showed a mosaic arrangement of the two colours but no moth was bred. Here again the melanic colour is a simple dominant to the type.

Heterochroism.

Quite a number of examples of insects are known in which halving or mosaic arrangement of type and aberrational colour has occurred without any gynandromorphism. Such are specimens of *Chelonia caia*, half type, half melanic, of *Aglia tau*, half type, half var. *lugens*, of *Acidalia virgularia*, half type, half ab. *bischoffaria*, of males and a female of *Psilura monacha* showing a mosaic of the colouring of the type and the ab. *eremita*, and of *Tephrosia crepuscularia* (*biundularia*) with a mosaic of the type colour and that of the ab. *delamerensis*.

Gynandromorphism with typical and sex-limited colour.

Many instances are known in which the female portion (half the insect or irregularly distributed areas) has shown a colour limited to the female sex, the male portion being typical.

Good examples are *Dryas paphia* and var. *valesina*, *Colias* and its pale female aberrations, of which *edusa* and its var. *helice* is the best known.

This segregation of the two colours is not always accompanied by a sex segregation. *Colias edusa* has occasionally produced a female, half *edusa*, half *helice*, and once one with forewings *helice* and hindwings *edusa*.

A phenomenon comparable to this segregation of a typical and a sex-limited colour is known in man. Nettleship once met with

identical (homogeneous) female twins, one colour-blind and one normal. Colourblindness is usually limited to the male sex and is a recessive character, the female only shows it when she has received it from both parents (*cf. grossulariata* and var. *lacticolor*). Identical twins are formed by the separation of the first two cleavage cells derived from the union of a single spermatozoon with a single ovum. Each of these two cleavage cells normally forms one half of the body of a single individual, but when accidentally separated each forms a complete individual alike in all respects.

But for the accident of separation of the two cells, at this early stage of development, an individual would have been produced half colour-blind and half normal, these corresponding to a butterfly, half *edusa*, half *helice*.

Hybrid Gynandromorphs.

The hybrids *Amorpha ocellatus* ♂ × *A. populi* ♀ and × *A. populi* var. *austati* ♀, hybrids *hybridus* and *operosa*, always produce a number of males, a few gynandromorphs and no females.

The gynandromorphs have with one exception a female appearance and are symmetrical. Their sex glands, ovaries, are atrophied and the accessory organs distorted and deficient. The external genitalia show a mosaic arrangement of male and female structures. Somewhat similar gynandromorphs, but with less blending of male and female characters, have occurred in numbers in secondary hybrid *Saturnias* and *Bistoninae*, in which primary hybrid gynandromorphs are very rare. In these crosses primary hybrid gynandromorphs are sometimes halved and five halved gynandromorphs of hybr. *hybridus* are also known. These rare examples are probably of the same nature as halved gynandromorphs of pure race.

Gynandromorphous mongrel insects.

Brake, Goldschmidt and others have produced gynandromorphs by crossing *Lymantria dispar*, Linn., with its var. *japonica*, Motsch. In some crosses they appeared in large numbers and in others were absent.

Altogether three kinds of gynandromorphs were produced :

(1) *Female gynandromorphs.*—These were female in shape and size, with blended male and female colour or a mosaic arrangement of the two colours. They had ovaries, female secondary sex organs and external genitalia.

(2) *Male gynandromorphs.*—These were male in size and shape, and indeed, male in all respects except for patches or streaks of female colour on all the wings.

(3) "*Weibchen-männchen.*"—These were exactly like males except for tiny specks of female colour scattered all over the wings. Their sex glands were testes or were lobulated and contained oocytes and spermatocytes in all their follicles.

The external genitalia were male but modified so as to show some approach to female type. In all cases they showed a close approach to bilateral symmetry both internally and externally. Many of these

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gynandromorphs were fertile, the females functioning as females, the males and "weibchen-männchen" as males, but in the more pronounced examples sexual instinct or sexual function was lost.

Familial and Hereditary Gynandromorphism.

Gynandromorphs are calculated by Speyer to occur in nature in a proportion of 1 in 30,000; and, though in certain species such as *Saturnia pavonia*, *Amorpha populi* and *Polyommatus icarus* they occur more commonly, they are very rare even in these. It is, therefore, remarkable that a number of instances are known of several gynandromorphs occurring in one family. Such are the four heterochroic examples of *H. abruptaria*, bred by Simmons, the seven bred by Harrison and Main in *A. betularia*, and five *Aglia tau*, one ordinary and four heterochroic, bred by Standfuss. The most remarkable instance occurred in the boney-bee, *Apis mellifica*. One queen during a life of five years produced hundreds of gynandromorphs, many of them halved. Apart from these only fifteen gynandromorph honey-bees were known up to 1904.

Of races producing gynandromorphs probably by indirect descent one may quote Newman's *A. populi*, which produces about 1%, and Lang's *Aglia tau*, producing 1 in 600. Pantel and Sinéty found in two species of *Dixippus* (Phasmids), which had produced only females parthenogenically for many generations, a few males and halved gynandromorphs in subsequent generations.

Oberthür states that at Dompierre a race of *P. icarus* exists, which gives rise to halved gynandromorphs, of which 27 were taken by one collector in one season.

At Royston there is a race of *Agriades coridon*, which produces a great excess of females, and a small proportion of specimens having one side smaller than the other, and with a variable number of blue scales, male hair scales, androconia on the small side. More than 150 of these have been taken in the last few years. In addition a few examples have been taken with streaks of male colour, but having no male hair scales or androconia. Yet gynandromorphs of this species are excessively rare elsewhere. Kuttner reports an instance of hereditary gynandromorphs in a crustacean *Daphnia pulex*. Many families and four generations were produced by parthenogenesis, all giving about 20% gynandromorphs of predominantly female type, with occasional genetic hermaphrodites and males, the rest being females.

Theoretical Explanations of Gynandromorphism.

The many theories put forward may all be classed under four heads. The first rests on the supposition that they are formed by the fusion of two ova or from a binucleate ovum, the second, that they are derived from an abnormally dividing single ovum. The third is the Mendelian hypothesis based on supposed differences in the potency in the sex factors in different races and species. Scopoli foreshadowed the first by suggesting that his halved gynandromorphous *Phalaena pini*, was formed by the fusion of two pupæ in one cocoon.

Dorfmeister modified this and considered that two ova in one shell became fused and then separated, each uniting with half the other and so forming two gynandromorphs.

Much more probable is Doncaster's theory that gynandromorphs arise by the fertilisation of each nucleus of a binucleate ovum by a separate spermatozoon. The spermatozoa may differ in somatic as well as in sex factors and so produce heterochroism in addition to gynandromorphism. He has proved the existence of such ova and the possibility of their fertilisation in this manner, but points out as an objection that no gynandromorphs were produced by the race in which these binucleate ova occurred.

According to his theory as many heterochroic individuals without gynandromorphism as heterochroic gynandromorphs should appear in broods where heterochroic gynandromorphs have been produced. In the few instances known this has not happened, though simple gynandromorphism and heterochroic gynandromorphism have appeared together.

The second theory was first advanced by Menzel to explain the Eugster bees. According to Dziernou an unfertilised ovum of the honey-bee produces a drone, a fertilised one, a worker or queen. Menzel thought that in the Eugster queen the ova were slow in passing down to the *receptaculum seminis*, and that before they reached this point division of the nuclei had begun. The spermatozoon on entering the ovum fused with one half of the divided nucleus, whilst the other developed parthenogenetically.

The former produced the worker portion the latter the drone portion of a gynandromorph. Boveri supported this view and showed that sometimes hybrid sea urchins were produced, one half containing only maternal chromosomes, the other half containing those derived from both parents. The fatal objection to this view is that it does not explain the production of halved hybrid gynandromorphs with each half showing the characters of both parents to an equal degree.

Lang propounded the theory that an ovum divided and that each half united with a separate spermatozoon. If we accept the view that the example of identical twins, one colour-blind and one normal, was due to the same cause as gynandromorphism and heterochroism, this theory falls to the ground. The identity of this class of twins is due solely to their production by the union of a single spermatozoon with a single ovum.

Lang's alternative hypothesis that halved gynandromorphs are produced by the loss of a Mendelian factor (a mutation) in one of the first two cleavage cells of a normally fertilised ovum appears at first sight to be very satisfactory. When he extends it to explain mosaic gynandromorphs he is obliged to suppose a number of mutations of the same kind occurring simultaneously. Its impossibility is best shown by the heterochroic gynandromorphs with a coarse mosaic arrangement of colours. To explain these he must suppose that two independent mutations can occur simultaneously in a number of separate cells, and that neither can occur without the other. If they did so the areas of one colour would not coincide with the areas of one

sex, and those of the other with the other sex. The improbability of this makes the theory quite untenable.

Goldschmidt and Popplebaum have brought forward a purely Mendelian theory based on their breeding experiments with *Lymantria*. They suppose that sex and secondary sex characters are Mendelian factors (unit characters) comparable to simple somatic factors. In the majority of insects and in birds the male is a homozygous recessive for sex and the female a heterozygous dominant; in mammalia and in some insects the reverse is the case. This view of the sex factors is based largely on the behaviour of sex-limited characters in these groups.

Goldschmidt further supposes that differences in the potency of the factors for sex and secondary sex characters occur in different races of *Lymantria*, the bigger and more deeply coloured var. *japonica* being much more potent than the European *dispar*. In the first and succeeding generations of the cross-bred insects the *japonica* and *dispar* factors become arranged in various ways. Some, for instance, have the *japonica* factors for male secondary sexual characters and the *dispar* factors for the female secondary sexual characters. Though such insects should be females, the *japonica* factor for the male secondary sexual characters is so potent that such individuals show some of the male secondary sexual characters and are gynandromorphs. Many dozens were bred, and the number of female gynandromorphs theoretically expected in the different broods actually appeared. Similarly male gynandromorphs were found to be due to the prepotency of the two *japonica* factors for female secondary sexual characters over the two *dispar* factors for the male secondary sexual characters, and the weibchen-männchen were due to the great relative potency of the *japonica* factor for the male sex, which almost obliterated the female.

His conclusions seem to be well founded as an explanation of the *Lymantria* gynandromorphs. But I do not think they can be extended, as he suggests, to explain all gynandromorphs. The internal and external anatomy of his gynandromorphs is unlike that of the vast majority of natural gynandromorphs. He did not breed a single halved example out of the many dozens produced, though sixteen perfectly halved gynandromorphs of *Lymantria dispar* are recorded in Schultz' lists. The weibchen-männchen, which alone show genetic hermaphroditism, are unlike any natural genetic hermaphrodite, though one of these has occurred in *L. dispar* (a lateral genetic hermaphrodite). The external genitalia intermediate between those of male and female and symmetrical also differ from those found in natural gynandromorphs. In fact, the symmetry of his gynandromorphs is in striking contrast with the asymmetry of most natural gynandromorphs. According to Goldschmidt's theory, heterochroic gynandromorphs must show heterochroism because of a partial dominance of one colour over the other. There are two strong objections to this view. One is that where such partial dominance exists, as in crosses of some black with some white fowls, the result may be a mosaic arrangement of black and white, but never a segregation of black to one side and white to the other side of the body. The other

objection is that in strains in which heterochroic gynandromorphs have occurred, and in which one colour is a simple and complete dominant to the other, further breeding has shown that no change in the potency of the dominant factor has taken place.

Natural gynandromorphs, too, do not appear in numbers large enough to satisfy a simple Mendelian expectation, even in the familial and hereditary cases.

The most probable cause of origin of these natural gynandromorphs seems to me to be an irregular division of chromatin at the first cleavage, one cell obtaining more than its share, one less. In insects unequal division of chromatin can affect:

(1) *Factors for sex and for secondary sexual characters.*
Example: *Simple gynandromorphism.*

(2) *Factor for secondary sexual characters alone.*
Example: *Secondary somatic hermaphrodite* like Hertfordshire *coridon.*

(3) *Factors for sex and sex limited colour.*
Example: Gynandromorph like *Colias*, half *edusa* ♂, half *helice* ♀.

(4) *Factor for sex limited colour.*
Example individual like *Colias*, half *edusa* ♀, half *helice* ♀.

(5) *Factor for simple somatic character.*
Example *Heterochroism.*

(6) *Factors for sex and for simple somatic character.*
Example *Heterochroism and gynandromorphism.*

It is probable that ordinary gynandromorphism is much commoner than that where secondary sexual characters are involved alone, because both the factors for sex and for secondary sexual characters are carried by the same chromosome. Sex-limited characters are thought to be carried by the same chromosome also, and this would account for the relative frequency of the third group. Almost as many *paphia-valesina* gynandromorphs as simple *paphia* gynandromorphs are known.

Gynandromorphous hybrids may be explained on Goldschmidt and Poppelbaum's theory, but most likely the cause is a grosser physical one.

It is well known that the chromosomes of different species and genera often differ in number and size, and that in hybrids normal fusion and subsequent equal division of corresponding chromosomes cannot take place. A chromosome may be wholly lost and the factors borne by it may never appear in the soma of the hybrid. This accounts for the difference in reciprocal crosses and, where sex chromosomes are concerned, may account for gynandromorphism.

The theory of unequal division of chromatin at the first cleavage explains the occurrence of halved insects, but does not explain the incompletely halved and mosaic-patterned insects, which are so frequently met with and differ so markedly from gynandromorphous birds.

In birds each of the first two cleavage cells gives rise to one half of the body, and so we get a perfectly halved bird with sex organs

and secondary sexual characters, entirely male on one side and entirely female on the other.

In insects, according to this author, there is a syncytial arrangement of the ovum in cleavage and preblastodermic stages, which allows a considerable degree of nuclear migration to take place. Hence we get nuclei with different chromatin content arranged in almost any imaginable way, and, when migration has ceased, the groups of cells formed by subsequent divisions will lead to the mosaic arrangement of sex-glands, secondary sexual apparatus, and somatic structures, which I have already referred to and laid such stress upon.

Naturally nuclear migration is usually slight and so most insect gynandromorphs approximate to the halved condition.

The weak point of the theory is that nuclear migration has not been proved to occur, and its possibility is denied by some authors; its strength is that all the varied conditions met with are explained, including the fact that in heterochroic gynandromorphs, with mosaic arrangement, the areas occupied by one sex and the one colour always coincide.

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